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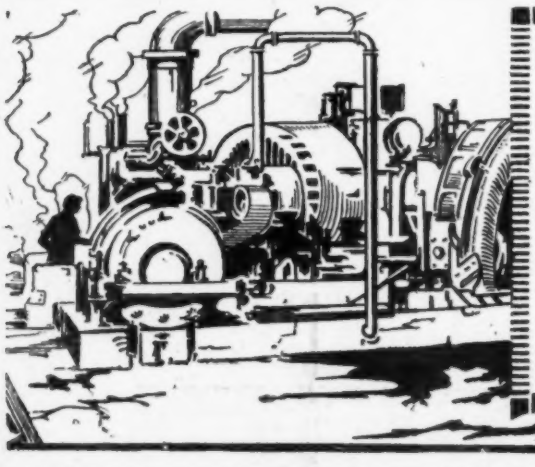

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The

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On Visiting Other Lands.

WE heartily welcome the announcement made in the King's Speech that the Prince of Wales will pay a visit to the Argentine next year in response to an invitation received from the President and Government of the Argentine Republic.

Royal and official visits to the Colonies not only increase the goodwill existing between ourselves and our overseas kith and kin, but they stimulate a keener interest in the resources and opportunities of territories that are so full of promise for our future. We invite the representatives of the Dominions to these shores for conference on important matters, and we are always anxious for our Colonial visitors to become better acquainted with our productive facilities and capacity by visiting our great factories, but, as Mr. Amery, the new Minister for the Colonies, has lately suggested, we must not only get our leading Colonial statesmen to visit the Homeland; we must consider statesmen's visits to the Dominions part of our official duty. We must confer with them on their own ground in the presence of their resources and under the stimulating influence of Colonial atmosphere and life. The better means of securing speedy and cheap communication will help immensely when we get them, but the visit always gives the personal touch that fosters relationships which have important results for inter-Imperial trade.

In the spring of 1925 the Prince will be in South Africa, and his journeying will include British possessions in West Africa and St. Helena. We trust that "happy results," to use the expression in the King's Speech, will attend these visits, for the Government policy aims at securing the closest co-operation with the Governments of the Dominions and of India as affording the key to industrial progress and to the increasing unity and strength of the Empire.

The visit to the Argentine, though outside the compass of the Empire family, is a matter of great significance in a financial and industrial sense. While inter-Imperial trade is a subject of immense concern because of the advantages that are anticipated for the British race generally from its extension, there are vast foreign lands where in the past we have lent a pioneering hand to their and our own advantage and where

such history should repeat itself in the comparatively near future if by Royal, official, and financial and trade delegations a good atmosphere can be produced, or co-operative accord can be introduced in place of an attitude of indifference. Our financiers, engineers, business men and merchants are quite as capable as ever of rendering expert co-operation in the developing of resources of lands which add abundantly to their own wealth as their resources are thus handled. In the Argentine and other parts of South America the British record is a great one, but sometimes one generation may forget what a previous generation has done, and in a temporary phase of public opinion things may be done which maturer deliberation and recollection find to be unwise. In recent years there has been in certain parts of South America, and quite lately in Buenos Aires itself, a disposition to act toward British companies which found large capital for development of public undertakings, with such a spirit as to call forth protest from those whose interests were slighted and to occasion suspicion in the financial heart of the metropolis.

The visit of the Prince to the Argentine will not only serve to impress the people of that great Republic with the goodwill of the British people and to impress those at home, who do not already know it, with the immensity of the opportunity for promotion of trading transactions and the application of engineering and scientific genius, but it should do something to re-establish in the whole of South America an interest in and respect for British influence which will inevitably strengthen the desire for fairness and equity.

It may be recalled that early in the present year in discussing the subject of "Argentine Finance" (Elec. Rev., February 15th, p. 243) we referred to the big engineering schemes in connection with which the co-operation of British firms was desirable for the mutual advantage of the Republic and of our own industries. At the last annual meeting of the B.E.A.M.A., the chairman, Mr. B. Longbottom, referred to the signs then apparent in the Argentine, in Chile, and in Brazil, that the long period of depression ruling in South America was over at last, and that there would be a greater demand for electrical goods.

Sir Philip Cunliffe-Lister, the President of the Board of Trade, who has recently visited South America, when speaking in London last week on "Overseas Trade," referred to the great trading openings that exist there. He dwelt upon the tremendous resources of the Argentine, its great economic and political stability, and its willingness to trade with Britain, and he alluded to the coming visit of the Prince as that of "the greatest ambassador, political or commercial, that this country ever had."

To all interested in engineering and electrical activity, South America has long been one of the principal remaining fields for effort. Much attention has been devoted to it by certain manufacturers acting independently, and the ground was investigated on behalf of many firms acting in a body. To-day, when the general disposition here and in some other leading industrial countries is toward quietness and stability and a larger inducement for the display of private enterprise, the time seems to be ripe for a revival of export trade effort either individually or collectively or both. Tours abroad have been made quite lately by leading electrical men, and the more of such visits there are the better. The Prince, as the Empire representative, is setting us an excellent example in this respect, and it would be well worth while for our great engineering societies or manufacturers' associations to consider whether they cannot with advantage organise some more Colonial and foreign visits.

If one of the biggest things that we did in 1924 was to welcome engineers from all over the world to the Power Conference at Wembley, let us make in the near future a not less important effort by paying a series of return visits: for to-day—in the Premier's words—we regard the seas no longer as a separator, but as a highway between nations.

Thermionic Rectification.

The facility with which alternating currents can be generated, and transformed in pressure up or down, and the advantages inherent to the use of direct current for transmission and, in some applications, utilisation, render it more and more important to be able to convert from one form to the other with efficiency and economy. Hence to the familiar rotary and motor converters have been added the mercury-arc and thermionic types of rectifier, and the Highfield-Calverley Transverter. Of the performance of the last named machine it is too soon to speak, but the thermionic rectifier is known to be inferior to the rotary types in that the resultant direct current is not perfectly uniform, behaving as if a small alternating component were superimposed upon it, which detracts materially from its utility. The fluctuations can be filtered out by means of inductance and capacity, but at very high pressures the provision of the necessary capacity presents some difficulty, the condensers being large and costly.

The ingenious idea has been conceived of so shaping the original a.c. wave-form that these fluctuations shall not be present in the rectified current, and in the *Journal* of the American Institute of Electrical Engineers for November, Mr. F. W. Maxstadt describes the method by which this object is attained, when using rectifiers of the Kenotron type, which, like the radio "valves," make use of a stream of electrons from a hot cathode. An abstract of the paper appears elsewhere in this issue.

By using a pole arc and coil span of 50 per cent. of the pitch, a triangular wave is generated in each leg of a three-phase star winding, and this results in flat-topped waves in the external circuit, which possess no third harmonics or multiples of the third, and if perfectly rectified give a true non-varying direct current within small limits—not exceeding 2.8 per cent. on either side of the mean. This is a great improvement on the result obtained with a sinusoidal wave—namely, 10.5 per cent. variation from the mean—and could certainly be made still better, the generator experimentally employed in this case having been an ordinary two-pole d.c. machine suitably modified.

The current output was only 50 milliamperes—but the pressure was 100,000 volts, the power therefore being 5 kW, and 20 kW could have been obtained from the Kenotrons if the rest of the plant had been larger. Who can doubt that the future will see rectifying apparatus of this type eventually constructed to carry thousands of kilowatts?

Licence Fees for Broadcast Reception.

In our issue of May 18th, 1923, Mr. W. H. Stoker, K.C., discussed fully the provisions of the Wireless Telegraph Act, 1904, in their relationship to the broadcasting position, and raised the question whether, under the powers conferred upon him by that Act, the Postmaster-General had in fact any authority to impose licence fees in respect of the use of apparatus for *receiving* messages only, or for either the transmission or the reception of musical performances. Mr. Stoker showed that it was very doubtful whether such licences and charges had any sanction under the Act, but, though possibly the Post Office appreciated the weakness of its position, no overt action was taken to strengthen it.

However, sooner or later the Postmaster-General was bound to be challenged on this point, and as we have recorded in recent issues, Mr. R. M. Ford has openly and aggressively defied the P.M.G. to make him pay—and the P.M.G. has refused to fight. Since then Mr. Ford has informed the Press that "the official view is 'that the spirit of the Act is not violated by the reception of signals,'" and he now proposes to secure the return to licence-holders of the fees that they have paid.

Obviously, if his contention is valid—and in all probability it is—the great broadcasting service which

has been developed and which gives pleasure daily to millions of our people has been built up on a foundation of sand, and the British Broadcasting Co.'s revenue is in jeopardy. The B.B.C. would apparently have a sound remedy against the Post Office, with which it has a contract that the latter may be powerless to carry out. But the situation cannot be left in its present state: the broadcasting service must be continued, and the licensing system must be legalised. We are therefore pleased to observe that the Postmaster-General intends to introduce an amending Bill into Parliament which will put the matter in order. Mr. Ford has done good service in forcing the matter to a head, and therefore the somewhat exuberant style of his communications is excusable; but he cannot be allowed to squash the broadcasting service.

Local Exhibitions.

NATIONAL exhibitions on a large scale are of considerable value in the education of the public and as propaganda of a general nature. Such expositions, however, are of greater direct benefit to manufacturers and traders than to the individual buyer. The last, if he requires any article which is exhibited, is often referred to an agent in his locality, and he may or may not pursue the matter to the end according to the depth of the impression gained at the exhibition. On the other hand, the visitor to a local exhibition experiences a sense of personal touch with those who are displaying their wares. They are in general fellow-townsmen with whom he can always maintain touch, and this gives a feeling of security.

The local electrical exhibition is pre-eminently of this nature. The user of electrical appliances likes to feel that if anything goes wrong (a rather exaggerated feeling generally) the man from whom he obtained the appliance is near at hand to correct or advise. Moreover, he can meet at the same time both the supplier of energy and the provider of appliances to use that energy; this is particularly useful for the newcomer to the electrical field. In one morning he can arrange a contract for supply and also select his fires, lighting fittings, irons, &c. Great credit is thus due to the organisers of such exhibitions; they are without doubt accomplishing much for the electrical industry. Both classes of electricity supplier—company and municipal—are rendering valuable service in this direction. We would specially mention the Shropshire, Worcestershire, and Staffordshire Electric Power Co., which has recently concluded a series of exhibitions at five centres in its area. We are told that over 40,000 people attended these exhibitions and had electrical appliances explained and demonstrated to them. On the municipal side the list is a long one. Each week we mention two or three examples. In our last issue Wakefield, Paisley, and Slaithwaite were noted, as well as a privately-organised show in Bradford, and an exhibition of a more general nature at Preston.

We think that very few undertakings that have tried the experiment will disagree with us when we say that these exhibitions pay for themselves—sometimes very quickly. The long dark evenings are the best for local electrical displays, with their brilliant illumination, electric fire warmth, electric cooking and the odours of hot cakes, and their demonstration of domestic labour-savers which lend their most effective aid in the winter time. We hope there will be many more such exhibitions throughout the country between Christmas and the spring time.

Short Wave Radio-Communication.

ADDRESSING a meeting of the Royal Society of Arts on Thursday last week, Senator Marconi added another sensation to the romantic record of radio-communication. He stated that the results of his further experiments on short-wave beam signalling had been so successful that the existing long-wave stations would shortly be obsolete, and stations of low power would be able to maintain communication continuously between all parts of the Empire—that is to say, throughout the compass of the world's surface. Moreover, he did not confine this forecast to telegraphy—he included the broadcasting of speech and music. Elsewhere in this issue we print an abstract of his paper.

Again we draw attention to the remarkable fact that whereas in recent years it had been held that very long waves gave the best results in long-distance communication, short waves have proved still more efficient, and the shorter the better; proceeding from 92 metres by stages down to 32 metres, the daylight range was found to increase rapidly as the wave-length was reduced, and with a power of only 12 kilowatts the Poldhu signals were received at Sydney, N.S.W., almost throughout the 24 hours. The small capital and running cost of the stations leads the Senator to anticipate a drastic reduction in telegraph rates at no distant date.

Senator Marconi took up the systematic study of short waves in 1916, and investigations were carried out on a large scale in 1920-21; but the most important experiments have taken place during the past twelvemonth. The recent trials have demonstrated the value of the reflectors used in conjunction with short waves for world-wide transmission.

The Post Office, which desires to dominate the wireless situation, could not have done this work. The atmosphere of State ownership is utterly unfavourable to departures from the normal; routine is the watchword of State organisation, and conformity to specified standard is its law. Senator Marconi, on the other hand, endures no such trammels—he sails half round the world and comes back in a few months with a revolution in his grasp. Can anyone seriously and in good faith advocate State ownership for technical enterprises?

The I.E.E. Wiring Regulations.

THE discussion on the new edition of the Wiring Regulations at the Informal Meeting of the I.E.E. on Monday last was, as anticipated, exceedingly interesting and well sustained. After the opening indictment by Mr. F. C. Raphael, who dwelt on the difficulties met with by a consulting engineer in the application of the regulations, the vice-chairman of the Wiring Rules Committee (Mr. Ll. B. Atkinson) and other members of the Committee had a very good innings, proving to demonstration that there was nothing in the Regulations that ought not to be there, and that the increase in cost of a complete installation due to their recent revision was at the most 5 per cent., whilst in some cases the cost was actually less than before. Admittedly the regulations with regard to the earthing of portable apparatus and with regard to flexibles and plugs could not easily be complied with at present, but it was contended that the manufacturers, though slow, would soon meet the requirements.

The evidence of leading electrical contractors that the increase in cost of first-class installations is negligible is interesting, but that is not the last word on the matter; we would prefer to see a material decrease in cost, particularly in the case of the smaller installations in private houses. It is quite certain that there are thousands of houses in this country in which the wiring does not comply even with the seventh edition of the Rules; yet it has served its purpose satisfactorily, for years—in many cases for 20 years and more. The fire insurance offices, as was made clear at the meeting, are not worried about them, and it cannot be alleged that they constitute an appreciable risk to life—we have yet to hear of a fatal shock in the living rooms of a private house. Precautions must be taken in bathrooms, kitchens, cellars, &c., where damp floors and earthed metal are met with, but even there it is impossible to obviate the risks that may be created after the contractor has left the job. Absolute safety is unattainable.

The Regulations may be accepted as representing an ideal worthy of the Institution and the associated authorities for first-class installations, but there should be a materially modified code or codes for less pretentious premises.

Britain's Electrical Imports and Exports.

The Trend of Trade Since the War.

THE annual statements for 1923 of the trade of the United Kingdom have at last been issued. Unlike the monthly accounts, which give but little detail of the countries participating in the trade, they record on the one hand the principal destinations of Great Britain's exports, and on the other the chief sources of her imports. At the same time a fairly detailed classification of the merchandise is adopted.

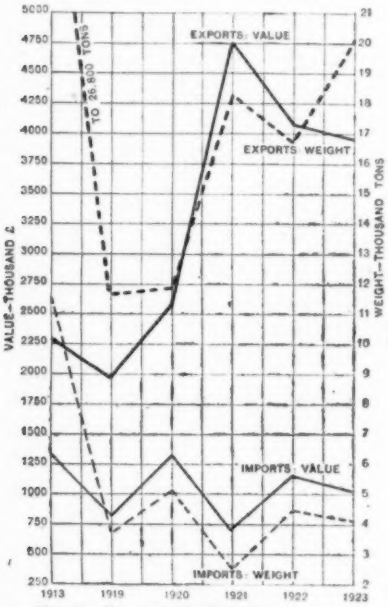


Fig. 1.—Imports and Exports of Electrical Machinery.

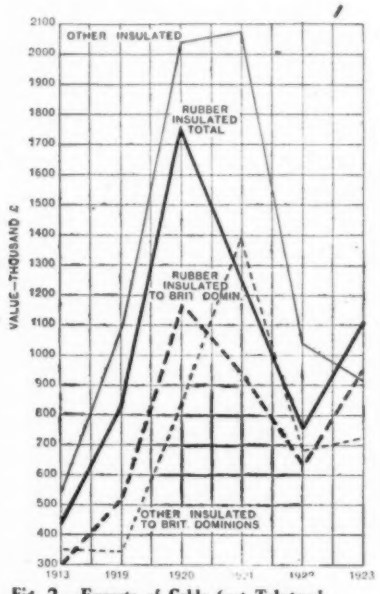


Fig. 2.—Exports of Cable (not Telegraph or Telephone).

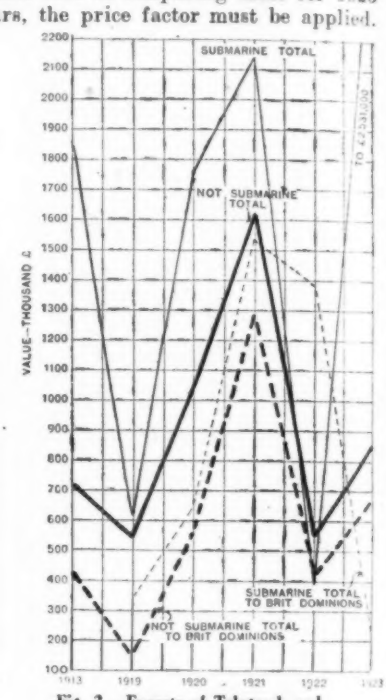
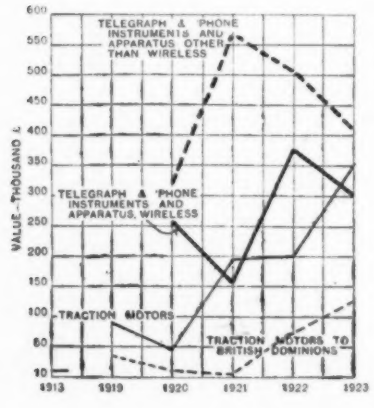


Fig. 3.—Exports of Telegraph and Telephone Cable.

It is possible to make some useful surveys of the trend of the electrical trade of the United Kingdom since the war. In comparing the statistics for 1923 with those of the preceding years, certain reservations have to be made. From April 1st, 1923, the trade accounts of the United Kingdom exclude the direct foreign trade of the Irish Free State, but include the trade of Great Britain and Northern Ireland with the Irish Free State. It is now known that the Free State ranks after India and Australia as the largest, on the whole, of Great Britain's export markets. Nine months (April to December) of last year's export figures are therefore swollen by the shipments of electrical material to the Irish Free State, thus vitiating to some extent any strict comparison with preceding years. The second reservation is with regard to values. Manufacturers will realise that in comparing those for 1923 with previous years, the price factor must be applied.

Dealing first with electrical machinery, as distinguished from electrical goods and apparatus (*i.e.*, cables, telephone and telegraph material, lamps, and instruments), it is found that the weights as well as the values imported and exported are recorded in the trade returns.

Accordingly, in fig. 1 are shown the values and weights respectively of Great Britain's imports and exports of electrical machinery in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TRACTION MOTORS
TRACTION MOTORS TO BRITISH DOMINIONS
VALUE—THOUSAND £

Fig. 4.—Exports of Wireless, Telephone and Telegraph Apparatus.

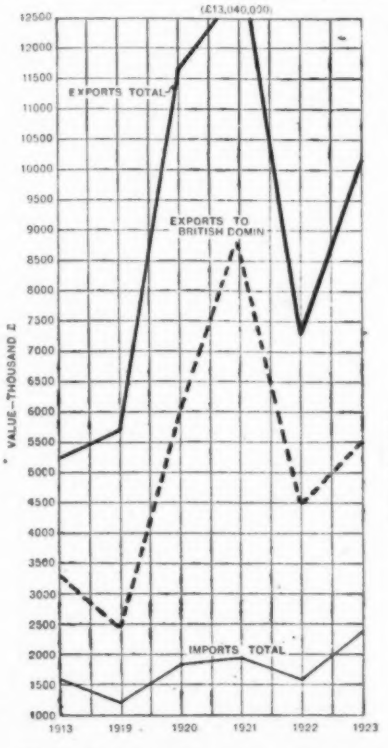


Fig. 5.—Imports and Exports of Electrical Goods and Apparatus.

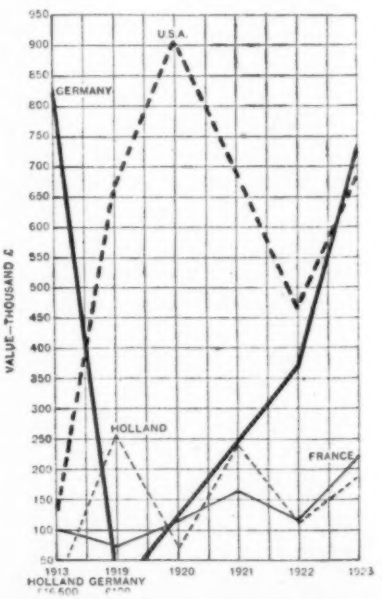


Fig. 6.—Origin of Imported Electrical Goods and Apparatus.

1923 and in a number of previous years. (In this and succeeding charts the years 1914 to 1918 are omitted because trade was then utterly abnormal owing to the war.) In connection with the weight, some allowance must be made for the alteration in the design of generators and motors in recent years, less metal now entering into the construction of a machine of equivalent capacity and value. It is interesting to compare the weight curve with the value curve. It will be noticed that in exports the peak in weight was reached in 1913, but, on the other hand, the peak in value was attained in 1921, and further, that between 1922 and 1923, although there was an increase of about 30 per cent. in weight, there was a decrease in value.

With regard to the imports of electrical machinery, last year the largest item was d.c. motors, details of imports being as follows, comparative figures for 1922 being also shown:—

	1922.		1923.	
	Tons.	£	Tons.	£
Total	403	116,780	659	182,240
Inclu. from Sweden ...	39	6,976	158	21,260
,, ,, Germany ...	122	13,274	81	12,520
,, ,, Switzerland	67	21,653	46	10,975
,, ,, U.S.A. ...	118	61,170	288	121,300

Last year's total was only 89 tons in weight and £16,275 in value less than in 1920. Imports of a.c. motors also bulked largely, *viz.*, 681 tons, value £90,000, more than half being supplied by Sweden and £18,555 worth by the United States. There appears to be room for improvement in the Customs classification of electrical machinery, for out of a total of 4,170 tons, value £1,016,000, entered as imported last year, 1,917 tons, value £556,892, is described as "electrical machinery, not elsewhere specified."

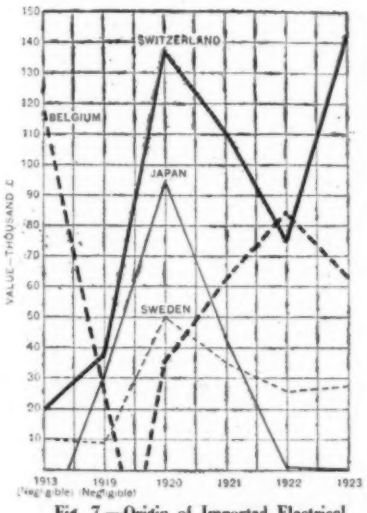


Fig. 7.—Origin of Imported Electrical Goods and Apparatus.

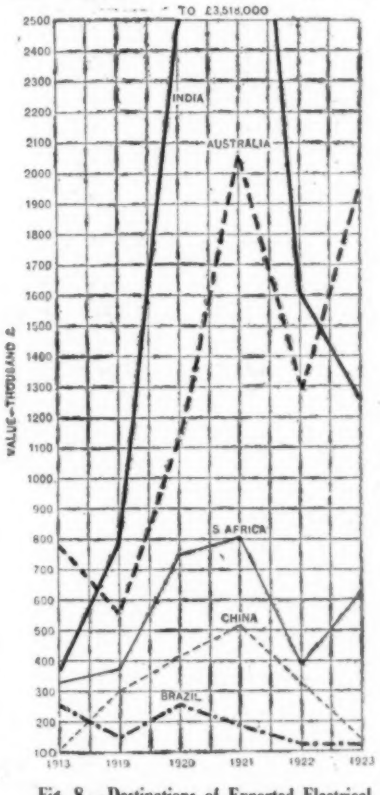


Fig. 8.—Destinations of Exported Electrical Goods and Apparatus.

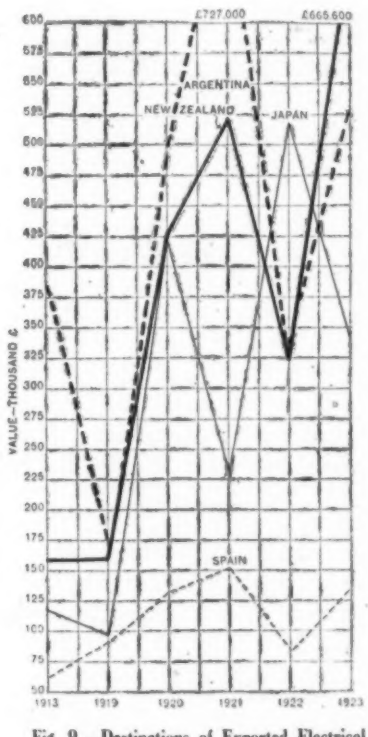


Fig. 9.—Destinations of Exported Electrical Goods and Apparatus.

With regard to electrical machinery exports, it is found that a consistent and striking advance has taken place in the traction motor business, which last year accounted for 9 per cent. of the total value of the electrical machinery exports, as compared with nearly 4.7 per cent. in 1919. This progress and the share which the Empire has taken in it is shown graphically in fig. 4.

A very large proportion also of the trade in other a.c. and d.c. motors is done with the Empire, *e.g.*, a.c. motors in 1923, £412,700, out of a total of £555,000; and d.c. motors in the same year £390,660 out of £493,250. The trade in a.c. motors has fallen off generally with both foreign countries and the Empire, and is not much more than half its value during the boom of 1921, weights as well as values showing decreases; d.c. motors, however, show an advance in weight whilst decreasing in value as compared with 1921.

	1921.	1922.	1923.
Motors, a.c., tons ...	3,928	3,185	3,293
,, ,, £ ...	1,051,300	755,930	555,500
Motors, d.c., tons ...	2,521	1,768	2,907
,, ,, £ ...	668,700	404,040	493,250

Other interesting items in the export trade in electrical machinery are shown below:—

British Exports.	*A.C. Generators.*			
	Tons.		£	
	1922.	1923.	1922.	1923.
Total	1,813	2,452	460,000	494,000
Inclu. to India ...	533	340	144,750	60,780
,, ,, Australia ...	401	547	104,450	135,900
,, ,, New Zealand	192	161	41,610	23,080
,, ,, Spain ...	10	375	2,595	86,990
	D.C. Generators.			
Total	1,837	1,854	458,600	380,500
Inclu. to India ...	431	429	138,500	80,110
,, ,, Australia ...	421	402	96,960	99,455
,, ,, New Zealand	168	132	45,186	24,670

Exports of Electrical Goods and Apparatus.

Turning now from the machinery trade to the more valuable business of exporting electrical goods and apparatus, it is found that cables represent the most important item in this branch. The course of trade in the principal classes is shown in figs. 2 and 3. Last year's shipments were, of course, far below those of the boom years of 1920 and 1921, but it is disquieting to find that had it not been for an exceptionally large sale of submarine cable to the United States (£2,131,000) in 1923, exports on the whole for that year would have been less than in 1922. It will be seen from the chart what a large percentage of the cable shipments generally has gone to the British Dominions in recent years. On the contrary, in the trade in telegraph and telephone instruments and apparatus, foreign countries have been our best customers, particularly for wireless apparatus. The trend of this comparatively new branch of trade relative to that of the older branches is shown in fig. 4.

For wireless apparatus and wireless valves (which are recorded separately), our principal customers are as follows:—

	1922.	1923.
Wireless instruments:	£	£
Total	377,000	300,000
Including to Belgium	5,770	14,300
,, ,, Greece	200	16,700
,, ,, Japan	173,600	98,640
,, ,, India	54,450	18,940
,, ,, Australia	2,320	22,700
Wireless valves, vacuum tubes and X-Ray tubes:		
Total	39,500	84,600
Including to Japan	6,000	21,000
,, ,, India	1,200	7,000
,, ,, Australia	2,400	12,400

In the following table the value of the imports of incandescent lamps during the period under review are set side by side with that of the exports. It will be noticed how imports have crept up again since the fall in 1920, although at the same time exports have been fairly well maintained.

Incandescent Lamps.

	Exports.	*Imports.*
	£	£
1913	152,400	196,000
1919	150,000	213,800
1920	319,800	75,500
1921	443,200	280,100
1922	362,600	213,000
1923	338,400	218,900

The relative position of the total import and export trade in 1913 and since the war in electrical goods and apparatus, together with the proportion of exports that went to the British Dominions, is shown in fig. 5.

It is useful to see what countries are now supplying our imports of electrical goods and apparatus and how their respective shares compare with their status in this respect before the war. Figs. 6 and 7 show the values of the imports (retained for consumption) of this group into the United Kingdom in recent years and in 1913. Reference should first be made again to fig. 5, giving the total imports of electrical goods and apparatus from all countries, from which it will be seen that the 1913 value was nearly regained in 1922 and exceeded in 1923. From fig. 6 it will be noticed that last year Germany made a big jump towards regaining her pre-war position and that the United States has succeeded in keeping a large proportion of the business that she won four or five years ago. In fact, competition seems to be growing wider as well as stronger, judging from the increasing imports from France, Switzerland, Holland, Belgium and Sweden. Only Japan shows a steadily dwindling trade.

Coming to the important question of our best customers for electrical goods and apparatus, figs. 8 and 9 show graphically for 1913 and 1919-1923 the value of our export trade in this group with the principal markets of the Empire and other countries. These charts tell their own story. It may be added that South America affords other good outlets than those shown, *viz.*:—

Exports to:	Peru.	Chile.	Uruguay.
	£	£	£
1913	10,500	77,600	15,900
1919	108,700	57,400	8,500
1920	341,500	87,800	28,800
1921	16,700	266,000	17,600
1922	4,450	288,000	7,800
1923	64,700	101,000	50,000

Battery Trucks and Edison Cells.

By "ELECTRODE."

One of the most satisfactory post-war developments has been in connection with electrically-propelled vehicles and in particular with the battery truck.

It can be safely predicted that, having demonstrated their usefulness by successfully emerging from that prolonged period of racking strain and stress which existed during the war, they have—like "Eliza"—come to stay.

With all electrical appliances, the chief aim of designers and manufacturers should be to attain, above all, reliability in service, and the electric truck which is used for manifold industrial purposes to-day is pre-eminently a reliable piece of apparatus.

In the broad sense of the word, a reliable article is also an efficient one, and it is perhaps not untrue to say that in the past we have directed our attention towards the attainment of high electrical efficiency rather than the achievement of mechanical reliability.

A clear conception of the actual working conditions will often provide sufficient information for the relationship which should exist between these engineering phrases and their translation into design, in order that the finished product may ultimately bear the hall-mark of endurance.

In the opinion of the writer, the ability to endure should be the outstanding characteristic of every engineering unit, but there have been instances in practice, unfortunately, where the accepted terms—efficiency and reliability—have been proved to be by no means synonymous.

As a result of this, one still experiences difficulty in convincing non-electrical engineers of the trustworthiness of electrical apparatus. To substantiate the claim of reliability and endurance in connection with the electric truck, it may be stated that the behaviour of a fleet of eight such vehicles has been under the daily observation of the author for several years, and the results are herein recorded.

In all weathers, at all times, routine work has to be performed in delivering castings from the foundries to the machine shops and thence to erecting bays, and also in maintaining a scheduled service between various feeder departments situated at distant points.

To accomplish all this, the crossing of many railway lines is unavoidable; the roads are rough, being more or less an extended series of small undulations, with cobble stones and gradients to complete the picture. In engineering establishments where a large volume of work has to be handled daily, the tendency is to load up as much material per journey as possible, and it has been no uncommon sight to see a one-ton truck bearing a load of over two tons.

It may be of general interest if the main points regarding defects and general maintenance are set forth under the following headings:—

(*a*) Truck wheels and axles.
(*b*) Motors and control gear.
(*c*) Batteries.

Truck Wheels and Axles.—No defective wheels were reported, but three broken axles occurred in five years, out of a total of 16 axles in operation, and the breakages were undoubtedly due to indiscriminate overloading and the rough condition of the roads.

Adjustment of driving chains, band brakes, and steering gear represented the extent of daily repairs required, as determined by a general inspection carried out each night.

Tire renewals were necessary on the average every 12 to 18 months, depending upon the service period of individual vehicles, but as a rule the truck mileage obtained per tire was about 3,000, which corresponded to 2,000 miles per 1-in. radial depth of solid rubber.

Motors and Control Gear.—The electrical equipment gave very little trouble, and not a single breakdown of any of the motors was recorded during the period under review. Repairs generally reduced themselves to questions of securing plug connections, and facing up ter-

minals, which had worked loose through vibration. Controller maintenance was reduced to the adjustment and cleaning of controller contacts. Every six months a general truck overhaul was carried out, the motors were stripped down, and all windings blown out by compressed air and painted.

Motors for battery vehicles are specially designed to give a high starting torque and a generous overload characteristic. The series-wound motor has been found to be most satisfactory, especially for industrial service, where the magnetic circuit is designed for partial

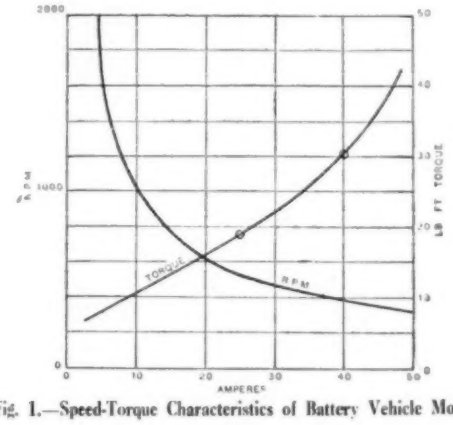


Fig. 1.—Speed-Torque Characteristics of Battery Vehicle Motor.

saturation only, in order that a suitable relationship between motor speed and load may be obtained.

A typical speed-torque characteristic curve of a battery vehicle motor is indicated in fig. 1.

Batteries.—The batteries throughout the fleet were exclusively of the iron-nickel type, regarding which but little information is published in the various text-books. In this, as in many other kindred equipments, the battery is the heart of the system; a little attention often bestowed is, in the main, all that is necessary.

For obvious reasons, the battery installed on any vehicle must be very robust in constructional details throughout. This condition is a *sine qua non*, and non-compliance with it has probably been responsible for delaying the advent of electrically-propelled vehicles

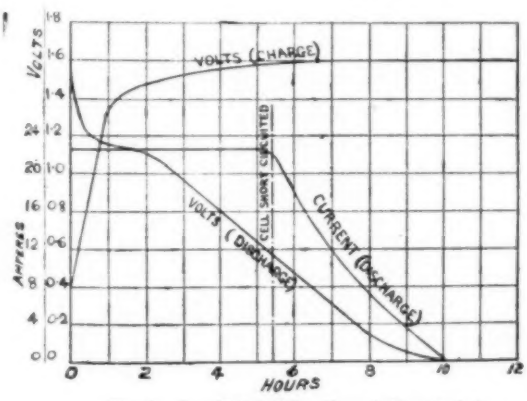


Fig. 2.—Iron-Nickel Cell. Normal Characteristic.

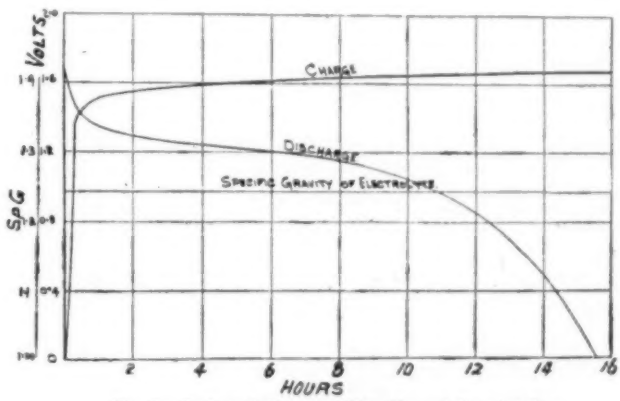


Fig. 3.—Prolonged Charge at 50% Normal Charging Rate.

owing to the inability of accumulator plates to resist successfully the incessant jolts and jars of road transit.

This drawback has now, to a very large extent, been removed, and in the iron-nickel cell its construction and design bespeak foresight and a true appreciation of the severe duty which the battery of any mobile unit is called upon to perform. No serious battery defects developed, and after five years' continuous service not a single cell plate has had to be renewed.

Generally speaking, the daily attention consisted of wiping down cell covers, "topping up" with distilled water to make good evaporation and wastage, and finally a seven-hours' full charge over the whole battery. However, it is most important thoroughly to wash each cell out after six to nine months' service in consequence of the accumulation of metallic sludge which is deposited at the bottom of the cell.

A cell-to-cell test will quickly reveal a faulty cell which has failed to establish its normal voltage after charge.

Usually the open-circuit voltage of such a cell is of the order of 0.5 volt only. Upon removing the cell, if the container was at all distorted or bulging outwards, the cell top was removed and the battery elements were inspected. A few of the positive and negative plates were usually found to be in contact, due to the small hard rubber separators having been dislodged, and thus no longer fulfilling their function of completely isolating adjacent plates. The chief cause of failure to attain the requisite potential difference at the cell terminals was, however, due to the deposit of metallic sludge short-circuiting the plates. In one instance this had reached a depth of 3/16 in. after 12 months' duty, where through an oversight the semi-annual rinsing-out process had been omitted.

As a matter of interest, some of this sludge was collected, and a rough analysis revealed the following proportions:—

Oxide of nickel	52%	(weight).
Oxide of iron	28%	,,
Caustic soda	8%	,,
Sulphate	6%	,,
Chlorides (not estimated) ...	6%	,,

Battery Overhaul.—When removing cell elements it is most advisable to wash off all traces of the electrolyte and to immerse the plates in fresh water; otherwise, as a result of local action, and the affinity which exists between the potassium hydrate solution and the ambient oxygen, the whole bank of plates will in a few minutes become too hot to handle.

The insulating separators should be detached and immersed in very hot water for about half-an-hour, wiped thoroughly clean, and allowed to dry.

This will enable a non-contact test between the poles of the cell to be accomplished after re-assembly of the plates and before renewing the solution. The latter is potassium hydrate (caustic potash solution), with an addition of lithium hydrate.

The cell containers are made from special nickel steel in order to withstand the action of the alkaline solution, and are coated with a special resistive paint. Experiments were made with mild steel containers, and these, when thoroughly cleaned and coated with two coats of special alkali-resisting paint, have so far proved satisfactory; after 12 months' service no deleterious action has been observed. Special care is necessary when refitting cell tops to ensure that a perfectly watertight seam is made around the edges. The tops should be a tight fit in the container and junction should be effected by an electric or oxy-acetylene weld.

Perhaps the most attractive feature which appeals to battery owners is the ability of the iron-nickel cell to stand up against complete short circuit without resultant damage to the plates.

Characteristic cell curves are shown, and indicate

the behaviour of a typical cell under varying load conditions. The curves refer to cells having a normal capacity of 225 Ah.

The average operating data compiled in connection with a 2-ton truck for a period of 12 months are tabulated as follows:—

Operating days	290
Average truck miles per day ...	9.5
Truck miles per annum ...	2,755
Charging energy per annum ...	3,050 kWh
Energy consumption per truck mile	0.9 kWh
Average material carried daily	4.5 tons
Miles per tire (average) ...	3,000
Starting current unloaded ...	60 amps.
Steady current unloaded ...	3 amps.
Daily cell readings (start) ...	1.55 volts
Daily cell readings (finish) ...	1.30 volts
Starting current loaded ...	80 amps.
Steady current loaded ...	10/25 amps.

The above figures are representative of hard-service conditions. For lighter duties over comparatively smooth surfaces, such as exist in railway stations, &c., a much longer life for all wearing parts will obtain with lighter maintenance expenses.

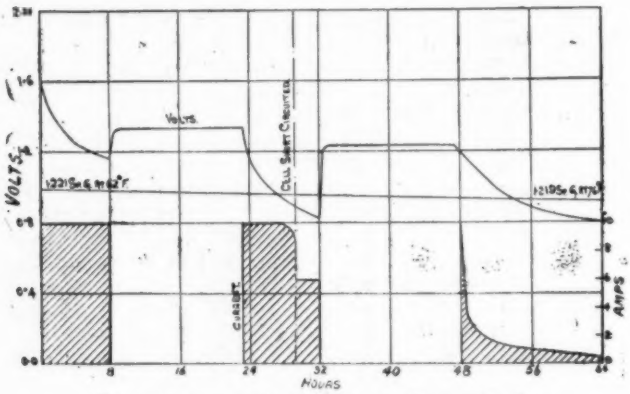


Fig. 4.—Interrupted Discharge, showing Recuperative Feature.

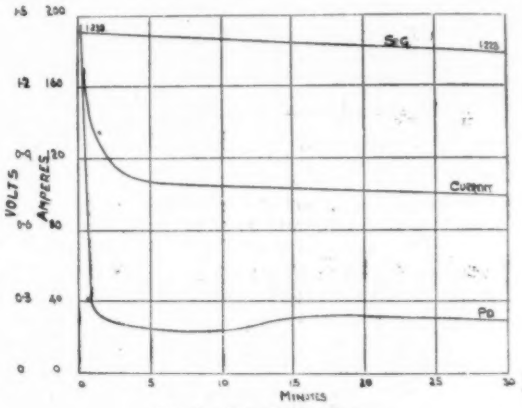


Fig. 5.—Short-Circuit Curves.

The following incidents will probably convey some idea regarding the sufferings of trucks and batteries when handled by "youth"—with its "long, long thoughts" (but not of batteries).

Some time ago a juvenile truck driver sauntered into the garage, perusing a small edition of detective literature, and casually referred to the fact that he was "stuck." This remark we found had reference to the battery truck of which he was the navigator, which had suddenly stopped about a quarter of a mile away. Repairing to the scene under his leisurely guidance, we lifted the floor boards and discovered that the battery cables were short-circuited. The cables were isolated, and after a hasty examination of the equipment, the vehicle was operated again after a 20-minutes' short circuit.

Another instance occurred during a very wet day, when, in negotiating the corner of a gradient, a truck skidded and overturned.

The chauffeur (!) surveyed the scene sufficiently to advance the information, upon his arrival at the garage, that something was leaking, and it hadn't stopped when he left.

The truck was righted, and before going for assistance to tow the truck home, we decided to try if any amps. could be persuaded out of the semi-dry cells. To our gratification we mounted the gradient slowly but surely, and crawled home to the accompaniment of many encouraging remarks *en route*.

Those who for years have been constantly engaged in striving to maintain electrical plant in a thoroughly reliable state, often under most onerous conditions, have realised that, in the majority of cases, failure has repeatedly occurred due to lack of inherent mechanical strength.

A small tribute to this hard metal cell with its insistent vitality is thus recorded, not because of any wonderful values obtained, but because it has been tried in the hard school of practice and not found wanting.

To this sturdy youngster—the iron-nickel cell—there would appear to be a field of promise along the many avenues of trade, and a future not without honour in association with electric vehicles.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

THREE years ago the American radio-telephone industry was of so little importance that the Department of Commerce, in compiling statistics, did not consider it worthy of separate classification; it was included with radio-telegraph and associated products, the whole being valued at less than £2,000,000. This year, however, according to Sir A. Maurice Low, the *Morning Post's* correspondent at Washington, it is estimated that the output of American radio-telephone apparatus manufacturers, including sets, parts, batteries, and other accessories, will amount in value to about £100,000,000. The production of radio-telephone equipment has become one of the leading industries of the U.S.A., providing work, directly and indirectly, for some 500,000 persons, employed by 3,000 manufacturers; in addition, there are 1,000 wholesale jobbers and distributors, and 25,000 retail dealers in that country.

A Special Selective Receiver.

Those interested in radio-telephony will recognise a number of novel features in the set illustrated in fig. 1, which has been specially designed for use in the East with a view to selectivity. The instrument comprises a valve heterodyne unit and an electrostatically-coupled receiver, but as it is intended for use in tropical climates the ordinary materials used in the manufacture of radio apparatus were not suitable; the panels have, therefore, been made of Paxolin instead of ebonite, as the former material is specially designed to withstand high temperatures and moist climates. In addition, instead of wooden cases the instruments are built into welded steel boxes, made from stout material.

The wave meter or heterodyne unit is fitted with a fine tuning condenser, situated on the lower right-hand side of the panel. This method of tuning, which was originally designed by the engineering chief of the R.I. research section, comprises a steel bevel wheel in a spring-adjusted bearing, and a brass bevel wheel under the dial of the variable condenser. The operation of the system is extremely fine, as there is no possibility of wear causing the friction drive to slip after a lengthy period of use.

The receiver itself consists of two loosely-coupled circuits, one tuned high-frequency valve, and two low-frequency intervalve transformers. Electrostatic coupling has been adopted to ensure the extreme selectivity required, also where a wide

range of wave-lengths has to be covered (namely, from 300 to 24,000 metres) without the use of any additional plug-in coils, or other accessories, it has been found better to use purely electrostatic coupling, rather than electromagnetic coupling, which is always accompanied by a large amount of stray capacity coupling. A further advantage of this method of coupling is that, for a given scale reading, the degree of coupling is approximately the same over the whole range of wave-lengths. Switches have been provided only for cutting out the low-frequency amplifying stages, but have been avoided in the high-frequency unit in order to eliminate capacity trouble.

The high-frequency system used in the instrument is a combination of anode reactance and resistance-capacity coupling, the former being employed for wave-lengths up to

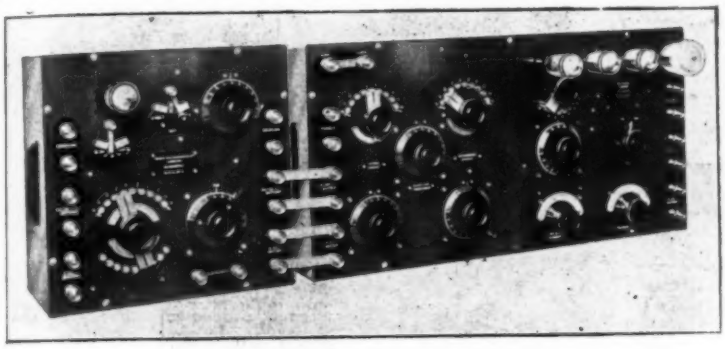


Fig. 1.—A Specially "Selective R.I." Set.

5,000 metres, with suitable tapping points, while the latter is used for wave-lengths from 5,000 up to 24,000 metres. It will be seen that each instrument is fitted with two sets of terminals, arranged so that short bus-bars can be used between each instrument on either side.

It may be mentioned that the first batch of these instruments was designed by Messrs. Radio Instruments, Ltd., for use by the Sudan Government some 12 months ago, and on account of these success as regards selectivity, sensitivity, and freedom from atmospheric troubles, a further order has been placed for the same type of instrument.

A New Crystal Set.

As will be appreciated from fig. 4, this new product follows the general lines of the "Anodion" series of receivers made by the Sterling Telephone & Electric Co., Ltd. The components are all mounted upon a sloping ebonite walnut case and the circuit is tuned by means of a new Sterling variometer, which is a compact instrument covering the broadcast range and employs an improved method of "one-hole" fixing. The company's semi-automatic crystal detector is fitted; the action of revolving a knurled disk rotates the crystal, lifting and replacing the silver contact spring automatically, so that finding a sensitive spot is easy and certain. Moreover, the contact is always kept at the right pressure on the crystal, and scratching its face is entirely avoided. By means of an ingenious switch and a fixed mica condenser the changeover from the broadcast wave-lengths to 1,600-metre reception can be effected merely by turning the range knob through 90 deg.

An Interchangeable Filament Resistance.

With the ever-increasing number of types of valve now on the market the question of filament current control requires careful consideration. If it is desired to change from

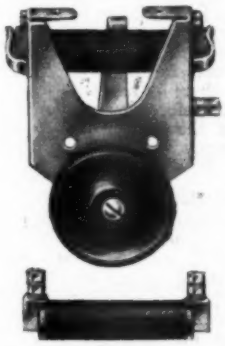


Fig. 2.—Sterling Interchangeable Filament Resistance.

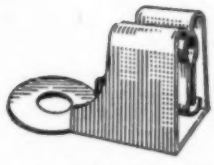


Fig. 3.—The "Klutch" Terminal.

the 0.06-amp. dull emitters to valves consuming much more current, considerably less resistance must be put into circuit, and at the same time its value must be capable of critical adjustment. The Sterling interchangeable filament resistance consists of a holder (and contact arm), as illustrated in fig. 2, into which may be clipped a cartridge resistance suitable for the type of valve employed. If a change of valves is made, the cartridge resistance is merely taken out and a new one of suitable value clipped in. The contact arm traverses the windings with a smooth action, and critical adjustment is easily obtained.

The "Klutch" Terminal.

We have received samples of the latest invention of Messrs. Henry Joseph & Co., Ltd., which is illustrated in fig. 3. The advantage of this device is that its use obviates the danger of a listener, by hurriedly moving and forgetting to remove his, or her, headphones, dragging the receiving set off the

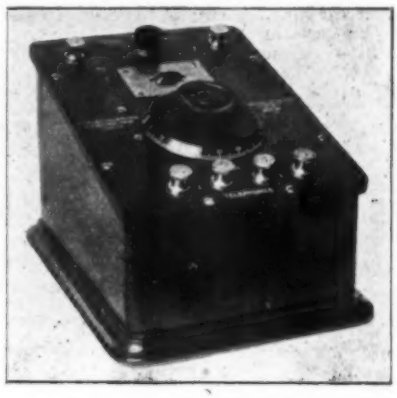


Fig. 4.—New Sterling Crystal Receiver.

table, and thus damaging it. Such an accident cannot occur when "Klutch" terminals are employed, as they are so constructed that the terminal pins will slip out directly any strain is placed upon them.

The "Sparta" One-Valve Amplifier.

Messrs. Fuller's United Electric Works, Ltd., have recently produced a compact form of single-valve amplifier. This apparatus, which is illustrated in fig. 5, is contained in a box of small dimensions, the filament rheostat and transformer

Fig. 5.—The "Sparta" Single-Valve Amplifier.

being packed closely together, leaving room for the valve, which is fixed in an almost horizontal position. The terminals are all on the outside of the case so that when the rheostat is set to the proper degree the case can be closed.

A French "Apprentice" Tax. — It is propsed by the French financial law to introduce a so-called "apprentice" tax which is to be imposed on manufacturers and merchants for the purpose of promoting the extension of technical education. The Syndicate Professionel des Industries Electriques has adopted a resolution expressing the opinion that this special tax should not be levied unless the proceeds are exclusively devoted to the development of apprenticeships within the framework of the Astier law of 1919, and not applied to expediture of general utility.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "K.B.B." Vibrometer.

MESSRS. KELVIN, BOTTOMLEY & BAIRD, LTD., have marketed a new vibrometer. This is of small weight in order that when it is attached to the machine under observation it will not sensibly affect the vibration or introduce lag. Referring to fig. 1, the vibrating reed R, slightly loaded at its free end, is clamped at its lower end in the jaws B formed at the foot of the upright pillar C. The movable spring clamp slides friction-tight on the pillar and carries a marker operating over a reed length scale E let into the pillar. The pillar can be set so that the plane of the vibration of the reed is in any angular position (indicated on the turret angle scales engraved on the blocks) and the pillar clamped in any position. The spanner-shaped carrier arm A is adapted for securing the vibrometer to the machine under test—for example,

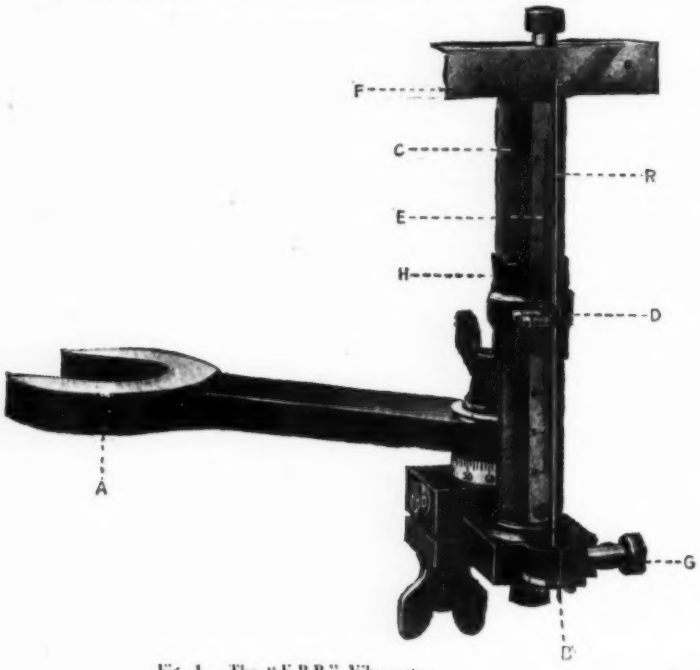


Fig. 1.—The "K.B.B." Vibrometer.

under one of the bearing nuts. By means of the sliding bush H, which carries D, the free length of reed is varied and the reading on the scale E when the reed is thus tuned (when referred to the calibration curve supplied for the particular reed in use) allows of the frequency being read off. An amplitude scale F is provided at the upper end of the pillar C for the purpose of indicating relative intensity of vibration when the reed has been tuned by moving the bush carrying the spring clamp D. Reeds of different thickness, and loading may be used for different speeds, and with each instrument three reeds are supplied covering speeds of from 300 to 5,000 r.p.m., with their calibration curves. The instrument is compactly contained in a leather case.

In many cases the maximum vibration is not in the horizontal plane. To provide for this the pillar can be canted over and any increase or decrease of amplitude can be noted.

The G.E.C. Bandit Alarm.

The frequent raids made recently by so-called "bandits" upon business premises and private houses lead to the consideration of alarm devices. The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, has developed a simple system in which, by means of a foot-switch, a shop assistant or bank clerk can raise an alarm without drawing the raider's attention to his action. The switch closes contacts which operate a powerful bell, which not only gives an alarm but startles the "bandit" and puts him off his guard. A similar device, in which a siren is used to obtain the same effect, was recently described in our pages.

The "Ferranti" Calcium Chloride "Breather."

MESSRS. FERRANTI, LTD., Hollinwood, Lancs., have applied for a patent in respect of a new design of calcium chloride "breather" for transformers which they have evolved. This device, as will be seen from fig. 2, consists of a cylindrical vessel with two detachable flanges clamped air-tight at its ends. This contains a central vertical tube secured to the upper flange and provided at its upper end with a number of radial holes. The upper flange is also connected by a socket to a pipe communicating with the conservator vessel, and the lower end of this tube bears a running nut which supports a grid. The lower end of the vertical tube is also secured to the lower flange, and this flange is provided with a series of holes, through which the extracted water passes after it has escaped through the grid. Around the holes in the lower flange is an annular projection, and concentric with this is a cast cylindrical casing provided with a conical base.

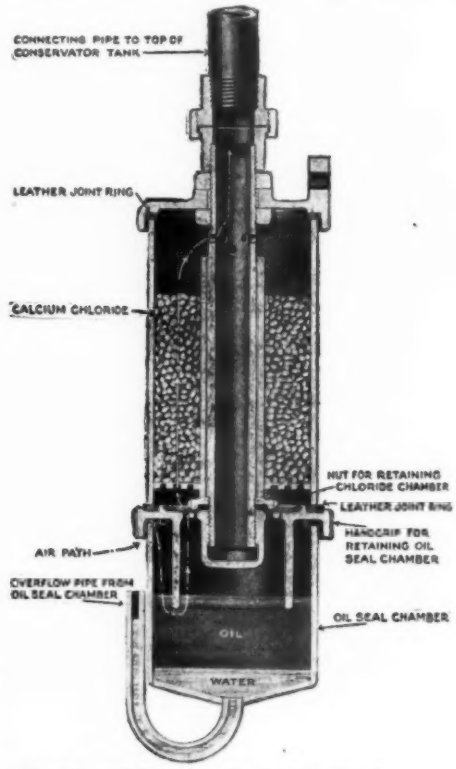


Fig. 2.—The "Ferranti" Calcium Chloride "Breather."

This casing has a number of notches, so that the air is free to pass through them. At the lowest part of the conical base a "U" tube is connected, the free end of which extends above the lowest point of the annulus. The lower casing contains oil to a level just above the lower point of the annular projection, and a certain amount of water is contained at the bottom of the oil, and also fills the U tube. In operation, a charge of calcium chloride is placed in the annular space above the grid and is connected to the air release pipe. When the transformer is cooling down there is an inflow of air through the notches at the bottom of the lower flange downwards to the oil seal, forcing the oil down. The air then travels up through the holes in the lower flange and by way of the calcium chloride through the connecting tube to the conservator, thus entering the transformer in a dry condition. Passage of air when the transformer is on load is in the opposite direction, but when there is no flow either way the oil seal is not broken, and therefore depreciation of the calcium chloride is restricted to the periods during which there is an inflow of air. The separated water sinks below the oil seal and is drained off by the U tube.

Brown-Boveri Arc-Welding Plant.

The advantages of electric arc welding have been acknowledged for many years, and its use has been recently considerably extended. While much depends upon the skill of the operator, it is essential that the generator should be provided with the special characteristics required for welding. The usual method of pressure control is by the use of more or less series resistance, the generator being run at approximately constant voltage. With the object of overcoming this disadvantage a welding plant has been designed and is marketed by BRITISH BROWN-BOVERI, LTD., Trafalgar House, Waterloo Place, S.W.1, which not only has the correct characteristics, but for which it is claimed that a saving of 30 per cent. is effected when compared with the more usual electric welding methods employed. The generator of this

plant is provided with a special compound winding, and while a series resistance is used, it is of very low value and only for the purpose of steadying the arc. The adjustment of the voltage is obtained through the medium of the shunt field, for which purpose a rheostat is supplied and placed close by the operator at the welding point (see fig. 3). This enables him to adjust the voltage at any moment to suit the weld in progress.

For ignition purposes the full generator pressure is needed, and is obtained by simply depressing a contact on the electrode holder—immediately the arc has been struck this contact is released and the pressure drops to the normal required for welding. In the illustration the operator is about to strike the arc and has his finger on the contact referred to.

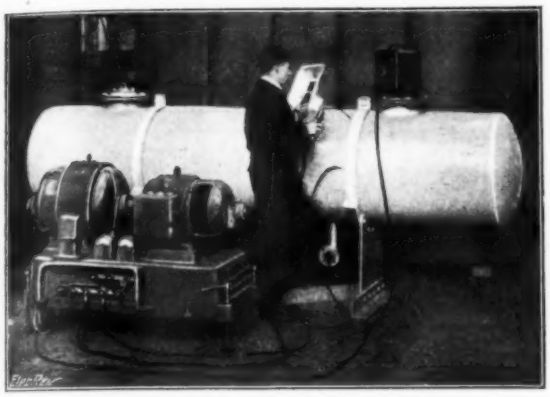


Fig. 3.—Brown-Boveri Arc-Welding Plant.

The steadying resistance can be arranged for parallel or series connection, and is mounted in the baseplate immediately below the generator. It is cooled by the powerful draught of air from the latter, and the draught is then discharged through the openings in the end of the bedplate seen next to the operator. As it is essential that the electrodes should be perfectly dry before use, a rack is fitted where the hot air leaves the bedplate and the electrodes can be placed across this.

The set has not only the accessories already referred to, but also the motor starter, ammeter and voltmeter, which are mounted on the unit. In addition, to make the whole equipment complete, it is provided with screen, gloves, chipping hammer for the slag, and wire brush. The unit itself is mounted on wheels, and is provided with jacks to level up and fix its position at the welding point.

Legal.

Kohn v. Batty.

IN the Mayor's and City of London Court, on December 9th, before Mr. Registrar Dell, Mr. B. E. Kohn, import merchant, claimed £5 3s. 11d. for goods supplied to Mr. C. F. Batty. Defendant's solicitor said that there was a dispute over an item of £3 5s. in respect of a "Tovey" electric vacuum cleaner. Defendant admitted the rest of the claim, and had paid 10s. into Court. It appeared that the vacuum cleaner had a 110-V motor, and defendant, having a supply at 150 V, was unable to use the appliance. The plaintiff said that defendant had chosen the appliance himself; they had never stocked a 150-V cleaner. Defendant had sent the machine back, but plaintiff refused to accept it as it had been used or tampered with.

The Registrar considered that defendant knew that the machine was not suitable—the voltage was marked upon it. He therefore gave judgment for the plaintiff for the sum of £3 12s., in addition to the money paid into Court, with costs.

British Thomson-Houston Co., Ltd., v. Charlesworth, Peebles & Co.

THE hearing of the appeal of the defendants in this case was continued on December 10th, the appellants' case still occupying the attention of the House when the hearing was resumed after a break for two days owing to the opening of Parliament. The respondents in this case, and the whole of the English case, in which the British Thomson-Houston Co. are appellants, have to be heard before any decision will be given.

The hearing was continued on December 11th.

Mr. CONDIE SANDEMAN, K.C. (the Scottish Dean of Faculty) presented the case for the British Thomson-Houston Company. He said that there were two or three dates which were important. The 1906 specification was applied for in September, 1906, and the complete thing was launched in March, 1907, and accepted in the following September, so that it became a public document in that month. The 1909 specification was applied for in October, 1909, and accepted in January, 1911. Until 1910 no drawn tungsten wire was made.

LORD BLANESBURGH remarked that that was, therefore, not under the 1909 specification, which was not accepted till 1911. Mr. Sandeman assented.

LORD BLANESBURGH: But, not known till 1911.

Mr. SANDEMAN replied that it was known under the provisional specification. He said that no such wire was ever made before the 1909 specification.

LORD DUNEDIN thought it was really a matter for argument whether this was made under the 1906 or 1909 specification.

Mr. CONDIE SANDEMAN said the 1906 specification did not disclose what they were then looking for. The question was what they had said must be done: what they taught on the subject. Counsel then referred their Lordships to passages in the evidence given by Dr. Otto Oberlander.

LORD SHAW remarked that as he understood the contention no one ever heard of a drawn tungsten wire with the desirable qualities before the respondents' invention. Mr. SANDEMAN said that was so.

During a brief discussion upon the subject of "ductile cold," LORD BLANESBURGH remarked that the respondents were running for all they were worth in this litigation, that they were able to get something ductile cold.

Mr. SANDEMAN said the evidence to which he had referred their Lordships was descriptive of this discovery. He next dealt at length with the state of knowledge prior to the 1906 specification, and for that purpose referred the House to further passages in the evidence, and especially in that of Mr. Horatio Ballantyne. He next drew attention to documents in the case, including translations from German, in which the term "tantalum" was frequently used.

LORD HALDANE remarked that the production of "tantalum" was a process about which they had hitherto heard nothing.

Mr. SANDEMAN said that one translation of 1911 set forth that if it was possible to carry out the production of such ductile tungsten industrially on a large scale, the invention was very important, and the scope could not at that time be anticipated.

LORD HALDANE called attention to a passage which said that it was natural that those who had succeeded in industrialising tantalum should next transfer that method to tungsten. But there were extremely important differences noticeable: first, tungsten was less ductile than tantalum and then it could only be melted with difficulty even under the conditions in which tantalum was obtainable regularly. His Lordship observed that tantalum was, therefore, not a new method.

Mr. SANDEMAN: But they did not succeed with tantalum.

LORD HALDANE: That does not appear here.

Mr. SANDEMAN: But I can tell your Lordships so. He then went on to refer to different specifications, and said in respect of the one under consideration that the metal could be rolled at dull red heat in the open air.

LORD BLANESBURGH said he did not remember anything in the specification which said it could be done at dull red heat.

Mr. SANDEMAN pointed out different parts of the specification and also the statement of claim.

Counsel then went on to discuss the judgments of the Scottish Courts on the question of infringement, and on the following day (December 12th), he continued his speech and dealt with the case in which the British Thomson-Houston Co., in 1913, raised an action in the Chancery Division against Duram, Ltd. In that action it was held by Mr. Justice Astbury that the 1906 patent was invalid on the ground of want of subject matter. This decision was upheld by the Master of the Rolls and Lords Justices Warrington and Scrutton in the Court of Appeal. Appeal was then taken to the House of Lords, where these judgments were confirmed on the same grounds by a majority. Lord Dunedin dissented, taking a favourable view of the merits of the invention and the validity of the patent. The validity of the 1906 patent was attacked in respect of the first claim in its specification "the method of working tungsten, which consists in subjecting the metal in a coherent form to the action of heat while it is being operated on or manipulated." It was held that the expression "the metal in a coherent form" could not be construed as confined in meaning to the form produced by sintering the rods of coherent powder by the methods disclosed in the specification, but that this claim was applicable to an ingot, or any other coherent form of metal. It was also decided that the patentee, whose patent might otherwise have been good, had claimed too much, and that the claim was too wide to be proper subject-matter for letters patent. That it would "prevent others from generally availing themselves of the common tools and routine of the metal worker for the purpose of making use of a property inherent in the metal itself."

Mr. SANDEMAN contended that in the 1909 patent persons were given working directions which might have been wanting in the 1906 patent. His submission was that the Duram decision was, in effect, that one could not get protection which would prevent other people proceeding in the ordinary working of a trade.

Mr. HUNTER GRAY, K.C., followed Mr. Sandeman on behalf of the British Thomson-Houston Co., and said that tungsten was so brittle that some process had to be found by which it could be made a success commercially. The British Thomson-Houston Co. had shown how this could be done, and it was not until it did so that it became commercially workable. It was the first practical attempt to get it into such form, and the patentee had succeeded in arriving at a satisfactory solution of the problem.

LORD BUCKMASTER said the real question which their Lordships had to try was whether the specification particulars, and the practical steps described, were sufficient disclosure to protect the patentee.

Counsel was then questioned by their Lordships with respect to some experiments made at Rugby in 1914, and their Lordships remarked upon the fact that no witnesses were called with reference to them.

LORD HALDANE said the fact that these expert witnesses were not called made him a little suspicious as to what they might have said had they been examined.

Mr. GRAY then proceeded to go in detail into the particulars of the 1906 and 1909 patents.

SIR DUNCAN KERLY replied for the appellants and said that the 1909 patent simply repeated that of 1906 in substance, and was, therefore, much in the same position. He submitted that there were insuperable difficulties in the respondents' way in this case. He had not concluded when their Lordships adjourned till December 15th.

On this date their Lordships reserved judgment, and proceeded to hear the English case, The British Thomson-Houston Co., Ltd., *v.* British Insulated and Helsby Cables, Ltd., in which the Court of Appeal, reversing Mr. Justice Russell, held the 1909 patent to be invalid.

In this case the appellants were represented by the Dean of Faculty (Mr. Condie Sandeman, K.C.), Sir Arthur Colefax, K.C., Mr. James Hunter Gray, K.C., Mr. James Whitehead, and Mr. W. Trevor Watson. For the respondents were Sir Duncan Kerly, K.C., Mr. Courtney Terrell, K.C., and Mr. D. H. Corsellis.

SIR ARTHUR COLEFAX said that this case stood in much the same position as the Scottish one, but he desired to bring forward prominently considerations which he felt to be fundamental. What seemed to him to be the true position was that the question of construction to be placed upon the specification was a matter for the Court, but the Court should read it in the light of a person instructed in the art, and of the knowledge that existed at the date of the patent. When he came to ask the House to consider what the 1906 patent meant he would ask their Lordships to look at it as a whole, and they should look at it and appreciate and apply what was then known. When they came to the 1909 patent he would point out that it was fundamentally different. Tungsten was a metal which even when hot was practically devoid of ductility at all. That being so it was certainly devoid of any ductility cold, and theirs was the only method by which it could be made ductile. It was part of his case that a filament could not be obtained under the 1906 patent, while what was published in 1909 was unique.

LORD SHAW remarked that the 1906 patent was claimed to have done wonderful things.

SIR ARTHUR said that the 1906 patent covered working on a broad basis. He also referred to the experiments made at Rugby.

LORD BUCKMASTER said those making the experiments ought certainly to have been called, and counsel should not have trusted to his own exposition of what had happened.

LORD DUNEDIN asked whether when the case was before the House in 1913 it was the contention that the 1906 specification was good.

SIR ARTHUR replied that no patentee came into Court saying his patent was bad. He then proceeded to read the specification and other documents, and having referred at some length to the 1906 patent, during the course of which some reference was made to the Rugby experiments, he then, by desire of their Lordships, proceeded to deal with the 1909 patent.

The further hearing was adjourned till the following day.

Radio-Telegraphic Communication.

Senator G. Marconi's Forecasts.

SENATOR G. MARCONI delivered his address as Chairman of the Royal Society of Arts on December 11th, in the course of which he made a forecast of important improvements and development in radio transmission and reception, as distinguished, of course, from broadcast radio-telephony. The address should have been delivered in November, but was postponed owing to the absence of the Senator abroad.

In his opening remarks Senator Marconi said that the whole theory and practice of long-distance transmission was just now undergoing a most important and radical change, which fact went to prove that it was dependent upon phenomena with regard to which their understanding, to say the least, had been to a very large degree incomplete. How was it that "wireless" waves could travel so far and bend right round the globe instead of shooting off into space? The hypothesis now generally accepted was that the waves were reflected by the Heaviside layer, which was supposed to be a conducting layer of rarefied and ionised gases constituting a "shell" concentric to the surface of the earth. Another theory that had been put forward by Prof. J. A. Fleming was that the waves were reflected by a more or less sharply defined conducting upper layer of the atmosphere containing highly ionised dust flung off by light pressure from the sun. A further explanation was put forward by Dr. W. H. Eccles in 1912, who pointed out that mathematical calculations showed that an ionised rarefied atmosphere was capable of increasing the speed of electric waves, so that if the ionisation increased from the ground upwards, the top of the wave should travel faster than the foot and, in due course, should actually lean forward, thereby following the curvature of the earth.

Those theories and other hypotheses to which he had not referred, continued the lecturer, had never satisfactorily explained to his mind why waves of a certain length would cover great distances by daylight, whilst others would only cover similar ranges at night time. He himself had discovered that fact in 1902 during experiments between Poldhu and a ship in the Atlantic, when he was able to get signals up to a distance of 2,000 miles at night, using waves of 2,000 metres, whereas during the day he failed to get them at 700 miles. Hitherto, he believed it had been universally accepted that short waves, whilst often giving extraordinarily long ranges at night, were incapable of being made to cover long distances by daylight. As a matter of fact, for a period of eight years from 1901, the Marconi Co. had installed on a considerable number of ships a system of spark transmitters utilising waves only 120 metres in length, which was commonly referred to as the "Tune A" system. Although utilising only a very small amount of energy, it was capable of regularly communicating over a distance of about 100 miles during daytime, but at night the range often exceeded 1,000 miles, although a comparatively insensitive tape receiver was employed. One of the advantages of that system was its comparative freedom from atmospheric disturbance.

Following references to his July paper on "Results obtained over Long Distances by Short-Wave Directional Wireless Telegraphy,"* Mr. Marconi said that "wireless" waves were far too valuable to be always broadcast in all directions; he could not understand why, for instance, messages intended for Canada or South Africa should be scattered simultaneously all over the world. It was easy to appreciate the utility of the non-directional system for many naval and marine purposes, but for ordinary efficient communication between fixed places, or between one country and another, the right and logical thing to do, if possible, both from the point of view of secrecy and economy, was to concentrate all the radiated energy into a beam directed towards the country or place with which it was desired to communicate.

Experiments were carried out, transmitting from two stations, to Norway in August, 1921, and at Christiansund day and night telephony was easily received from both stations. During those experiments the curious night distortion of telephone signals was discovered, particularly when transmission was overland, the major cause of which had recently been described by Captain H. J. Round in his work on broadcasting. During his own experiments on the steam yacht *Elettra*, said Senator Marconi, he discovered that the short waves being used could not only cover great distances by day, and much greater distances by night, but that they were quite reliable and that large parts of continents and ranges of mountains did not materially reduce their working distance. With regard to the series of tests over world-wide distances during the winter, spring, and summer of 1923*, while the limitation of the period of working to practically the hours of darkness constituted an undoubted disadvantage, still the economical advantages, together with the reliability and possibility of working this system at far greater speeds than would have been feasible with the high-powered long-wave installations, went far to convince him that the short-wave beam system would be capable of transmitting a far greater number of words per 24 hours between England and far-distant countries than would be possible by the comparatively powerful, cumbersome and expensive stations actually in use, or planned to be used, for Imperial commercial communication. It was therefore a satisfaction to him to be able to state—and he had no doubt that it would be justified—that the stations intended for this purpose in England which the Marconi Co. was now erecting under a contract with the Post Office—and others to be installed in the principal Dominions and far-distant countries—would all work on the beam system.

Commencing in August last, a further series of investigations were carried out between Poldhu and the yacht *Elettra*, the object being to find means of overcoming the limitation of working hours brought about by daylight and also to test whether the effect of the reflectors would give the

* ELEC. REV., July 25th, 1924 (p. 155).

expected increase of signal strength over long distances. The yacht proceeded to Spain, then to Madeira, and afterwards to Italy. From Naples he sailed for Beyrouth, in Syria, touching Messina and Crete, and returning to Naples *via* Athens. At Madeira it was ascertained that a reflector at the transmitting station increased the strength of the received signals in accordance with calculations, but that, nevertheless, when using a 92-metre wave, the daylight range was only very slightly augmented. At Madeira and other places in the Atlantic and Mediterranean, comparative tests with waves of 92, 60, 47, and 32 metres enabled the conclusion to be reached that the daylight range of practical communication over long distances increased very rapidly as the wave length was reduced. Thus, the 32-metre wave was regularly received all day at Beyrouth, a distance of 2,100 miles, whilst the 92-metre wave failed to reveal itself for many hours each day even at Madeira, a distance of only 1,100 miles.

Those results were so interesting that he decided to try further tests over much greater distances; in October last transmission experiments were carried out with a 32-metre wave from Poldhu to specially installed receivers at Montreal, New York, Rio de Janeiro, Buenos Ayres, and Sydney. Although the available power at Poldhu was only 12 kW, it was at once found possible to transmit signals and messages to New York, Rio, and Buenos Ayres, when the whole of the great circle track separating those places from Poldhu was exposed to daylight. During a complete day transmission at fixed hours, carried out last October with Sydney (N.S.W.), that station received Poldhu signals for 23½ hours out of the 24, and a 48-hour test (which was only completed on December 10th) fully confirmed the result.

The tests from England to places situated south of the equator, such as Sydney, Buenos Ayres, Rio, Cape Town, and New Zealand, were particularly interesting for the reason that in those cases the waves had always to traverse a "summer zone," and were therefore subject to an averaging effect of conditions, which could never exist when transmission took place between stations situated in the northern or southern hemispheres. During November some successful receiving tests were carried out in England from a low-power transmitting station in Australia utilising an 87-metre wave, whilst during December, 1924, trials were continued with Canada, the United States, Brazil, the Argentine, and Australia, as well as (for the first time) with Bombay and Karachi in India, and Cape Town in South Africa. The power utilised at the Poldhu station during all those tests was 15 kilowatts.

Senator Marconi was now convinced of the possibility of erecting stations for directional communication, using short waves, at a very much less capital expenditure than at present, which should bring about the possibility of a reduction in telegraph rates for all long-distance communication, besides making direct communication with some of the smaller outposts of the Empire commercially remunerative. Already the size and power of some of the modern long-wave stations was becoming a serious financial problem. The newly equipped station at Buenos Ayres, for instance, which was designed primarily for communicating with Europe over a distance of about 6,000 miles, employed 800 kW and an aerial supported by ten towers each 680 ft. high. That station usually worked on wave lengths of about 12,000 and 16,000 metres.

Another example was the British Post Office station being erected near Rugby which, when completed, would employ 1,000 kW and an aerial supported by 16 towers each 820 ft. high, whilst the station which the Marconi Co. was erecting in the Union of South Africa was designed on a similar scale. However, he was now firmly convinced that beam stations employing only a fraction of that power and much lower and fewer masts would be able to communicate at practically any time with any part of the Empire, and he could not refrain from expressing the strong personal opinion that powerful long-wave stations would soon be found to be uneconomical and comparatively inefficient in so far as long-distance commercial communication was concerned.

It was clear that the well-known Austin-Cohen formula was inapplicable to those waves without very big modification, and another formula would have to be devised, based on the results of further investigations. Experience so far had shown that the use of reflectors diminished "fading" and also tended to overcome its effects by enormously increasing the strength, and therefore the margin of readability, of the received signals.

If short waves were destined to carry a considerable part of the most important long-distance telegraphic traffic of the world, it might well be necessary in the near future, by international legislation, to regulate their use and safeguard them from preventable interference. The results obtained by amateurs with long-distance telephony and telegraphy had often been of great help to those engaged in the larger problem in better understanding the phenomena involved; incidentally, amateurs had recently been able to carry out two-way communication with New Zealand for brief periods.

Looking ahead, and speaking in the light of the work which had been accomplished with short waves, Senator Marconi said it might well be that the day was fast approaching when the practical range of broadcasting would be enormously increased and that American stations would be heard in this country with clearness and regularity. It was also reasonable to expect that it would soon be possible for an important speech to be broadcast to the most distant parts of the Empire, irrespective of whether it was made during daytime or the hours of darkness. The "wireless" transmission of pictures had already been effectively realised between New York and London, and one would have to be very bold indeed to forecast what might be the future limitations of radio transmission.

In conclusion, the lecturer expressed his special thanks to Mr. C. S. Franklin and his assistants for their work in designing and operating the transmitting plant at Poldhu and for the valuable work he had done in connection with short waves, and to Mr. G. A. Mathieu for the arrangement and management of the receivers on the yacht. Collectively, too, he thanked the numerous engineers and experts abroad who had assisted in the experiments.

Business Notes.

Bankruptcy Proceedings.—E. W. ADAMS (The Wireless Accessories), 664, Old Kent Road, S.E.—Discharge suspended for two years until November 12th, 1926.

F. P. CRAWLEY, radio vendor and motor engineer, Darwen Street, Blackburn.—This examination was held at Blackburn Bankruptcy Court, on December 10th. Debtor said that he formerly carried on business at the New Central Garage in Mincing Lane. He attributed his failure to a fire which occurred at his premises in July last. He began in the business in March last with a partner. Debtor contributed £220 and the partner ran the business, and the partnership was dissolved later. The premises were insured for £2,000, and the fire was estimated to have caused damage to the extent of £800. The insurance company, however, had not paid anything on the claim, because there was some disagreement as to the cause of the fire. The company did not question the liability—it was simply a matter of amount. Since May last he had paid off debts amounting to between £300 and £400. The examination was adjourned for the debtor to file a further deficiency account.

A. P. BIRD, 91, Shaftesbury Avenue, W.C.2, trading as the Bird Film Co. and the Wireless Exploitation Corporation.—This debtor attended last week at the London Bankruptcy Court for public examination upon accounts showing total liabilities £6,403 (unsecured £6,066) and net assets valued at £614. In the course of his evidence the debtor stated that he had carried on business as a film dealer, and in June, 1922, he added to the business that of a dealer in radio apparatus. Witness knew nothing about this class of business. In June, 1923, the trading name of the radio branch was changed to the Bird Wireless Co., and he continued both branches until a receiving order was made against him last July on the petition of a creditor. The debtor attributed his failure and insolvency to the slump in trade, to unscrupulous management prior to May, 1922, and to bad debts. The examination was concluded.

J. L. FORD, electrician and electrical dealer, 136, Queen Street, Great Harwood.—This debtor was examined at the Blackburn Bankruptcy Court, on December 10th. The debtor's deficiency was £205, and he stated that he commenced in the business in partnership with his father, who disappeared in March, 1923. The examination was closed.

E. DOWNING, lately carrying on business in co-partnership with E. J. Mills, manufacturers of electrical conduit fittings and general electricians, 143, Butts Road, Walsall.—First meeting December 16th, at the Official Receiver's office, 30, Lichfield Street, Wolverhampton. Public examination January 7th, at the County Court, Wolverhampton.

J. KINGSTON (Cromwell Engineering Works), electrical and general engineer, 176, Romsey Road, Shirley, Southampton.—First meeting December 18th, at the Official Receiver's office, Midland Bank Chambers, High Street, Southampton. Public examination January 21st, at the Court House, Southampton.

H. E. CHECKLEY, plumber and electrician, 20, West Street, Morecambe.—Last day for proofs for dividend December 24th. Trustee, Mr. J. F. Warburton, 28, Queen Street, Manchester.

L. A. RADFORD, electrical engineer, 50, Welford Road, Leicester.—First and final dividend of 1s. 11d. in the £, payable at the Official Receiver's office, 1, Berridge Street, Leicester.

H. E. MALLINSON, electrical engineer, Portelet, Tomline Road, Felixstowe.—Receiving order made December 1st, on debtor's own petition. First meeting, December 23rd, at 9, Arcade Street, Ipswich. Public examination, January 16th, at the Shire Hall, Ipswich.

D. E. Jones (D. E. Jones & Co.), electrical contractor, 29, Carne Street, Pentre, Glamorganshire.—First and final dividend of 2s. 3½d. in the £ (not 2s. 5½d.), payable at the Official Receiver's office, 34, Park Place, Cardiff (amended notice, *London Gazette*, December 12th).

L. Francis, electrical engineer, 2, Morrison Street, Castleford, Yorks.—Trustee, Mr. B. S. Briggs, Official Receiver, 21, King Street, Wakefield, released October 22nd.

J. E. Byrne, electrical contractor, 3, Wells Yard, Waterwork Street, Kingston-upon-Hull.—Receiving order made December 10th, on debtor's own petition.

R. Haworth, electrical engineer, 154, Duckworth Street, Darwen.—Receiving order made December 10th, on debtor's own petition.

M. O. Heckels, electrical wholesaler and agent, 643, Welbeck Road, Newcastle-on-Tyne.—Application for discharge to be heard January 22nd, at the County Court, Newcastle-on-Tyne.

H. N. Miles (Sheffield and Midland Schools of Wireless Telegraphy), wireless instructor, Central Chambers, High Street, Sheffield.—Trustee, Mr. L. J. Clegg, Official Receiver, 14, Figtree Lane, Sheffield, released November 24th.

Private Arrangements.—Wakeling & Wray, electrical engineers, Paragon Street, Hull.—A conference of the principal creditors was held recently, when a statement of affairs was presented which disclosed liabilities of £6,913, all due to unsecured creditors. The assets totalled £2,318, from which had to be deducted preferential claims amounting to £41, leaving net assets of £2,277, or a deficiency of £4,636. After discussion it was eventually resolved to accept a composition of 6s. 8d. in the £.

The following are creditors:—

	£		£
Bucklay & Hall	150	Lithgow & Akester	37
Beadle & Co.	330	Lighting, Heating & Gas, Ltd.	140
Barclay's Bank	261	London Radio Stores	22
Brown Bros.	70	T. B. Morley & Co., Ltd. ...	106
Britishers (Sheffield), Ltd. ...	22	Metropolitan-Vickers Electrical Co., Ltd.	159
British Wireless Supply Co. (1924), Ltd.	36	F. Morland	169
R. Barker	45	Norris, Henty & Gardners, Ltd.	127
Batting Bros., Ltd.	35	National Provincial Bank, Ltd.	1,268
B. Cooke & Son	20	Paragon Rubber Mfg. Co., Ltd.	26
Claremont, Johnson & Co., Ltd.	68	Reflex Radio Co.	30
Electric Lamp Factors, Ltd. ...	27	R. Rothermeo, Ltd.	22
Edison Swan Electric Co., Ltd.	20	Lionel Robinson & Co.	26
East London Rubber Co. ...	92	A. Shaw & Son	32
J. J. Eastick & Sons	37	Sheffield Supply Co.	90
Falk, Stadelmann & Co., Ltd.	34	Skelly & Bold	34
Fuller's United Electric Works, Ltd.	93	S. D. H. Mfg. Co.	59
Fellows Magneto Co., Ltd. ...	250	H. C. Tofield, Ltd.	120
General Electric Co., Ltd. ...	260	Harry Wray	620
C. Gilbert & Co.	175	B. Wainstone	24
L. G. Hawkins & Co., Ltd. ...	53	E. A. Wood	187
Houghtons, Ltd.	467	Wadsworth, Sellers & Co. ...	36
Hallamshire Electric Co., Ltd.	90	W. Whitehouse & Co., Ltd. ...	11
Hull Corporation	24	Yorkshire Electrical Supplies Co.	35
Jeary Electric Co., Ltd.	45	Holliday & Barker	73

Company Liquidations.—John R. Kinsey & Co., Ltd., electrical contractors, &c., Lower Addiscombe Road, Croydon.—A meeting of the creditors in this voluntary liquidation was held on December 8th, at Croydon. Mr. P. J. Poole occupied the chair, and reported that he had been appointed to act as the receiver for the debenture holder in the company, and also as the liquidator. He stated that the total liabilities were £4,802, and the assets were set down at £1,905. There were also contingent claims for £500. The company had a contract with the G.P.O., which he thought was of some value. The Liquidator further stated that the company was registered in the early part of 1922, when it took over an existing business as from August, 1921. The nominal capital of the company was £5,000, of which £3,636 was issued. Practically all the shares were issued for cash, although one shareholder received shares in exchange for goods. During the year ended August, 1922, there was a turnover of £11,977, with a loss of £1,417. During the following year the turnover increased to £15,300, but there was a loss on the trading of £1,168. During the four months to December 31st, 1923, the turnover was £5,500, with a net loss of £391. For the seven months to July 31st last the turnover was £16,000, with a loss of £2,381. The debenture holder was Mr. Charles Wood, who was an unsecured cash creditor for £702.

Mr. P. Wells, of the Wholesale Traders' Association, suggested that the directors might consider making an offer to the creditors. One of the directors replied that he was not prepared to make any offer, and eventually a resolution was passed to the effect that the voluntary liquidation of the company should not be confirmed.

"F. S." Petrol-Electric Omnibus Co., Ltd., Waterworks Road, S.W.2.—A meeting of creditors was held on December 11th, at the offices of the Liquidator, Mr. Sidney H. Clinch, 119, Moorgate, E.C. A statement of affairs was presented as at November 22nd, which showed liabilities of £4,271, all due to unsecured creditors. The assets totalled £2,849, from which had to be deducted preferential creditors for £98, leaving net assets of £2,751, or an estimated deficiency of £1,520. It was reported that the company was incorporated on March 19th, 1923, with a capital of 15,000 £1 shares. The company acquired the business of Mr. P. F. Smith, the consideration being 6,000 fully paid shares. From January 1st, 1922, to November 22nd last there was a profit of £232. The present position was attributed to lack of capital. The Liquidator stated that for a period of about two years Mr. Frost had received £1,136, in addition to which there was a director's fee of £12 per year. The receipts of the business from January, 1923, to November, 1924, totalled £31,627. No resolutions were passed, and the matter therefore remains in the hands of the present liquidator.

Catchpole & Maurice, Ltd.—First dividend of 5s. in the £ payable at the Official Receiver's office, Carey Street, W.C.1.

Telephos, Ltd.—Winding up voluntarily. Liquidator, Mr. J. R. Oldman, 729-730, Salisbury House, E.C. Meeting of creditors, December 23rd, at Salisbury House.

Dissolution of Partnership.—Bailey & Billamy, electrical engineers, 3, Cookridge Street, Leeds.—Mr. N. G. Bailey and Mr. G. H. Billamy have dissolved partnership. Mr. Bailey will attend to debts and continue the business.

Trade Announcements.—The Liverpool Electric Cable Co., Ltd., opened a branch office at 93, Pilgrim Street, Newcastle-on-Tyne, on December 1st. Stocks of wires and cables and flexibles are held there for the district, and Mr. T. H. Day has been appointed as the company's representative for North-Eastern England. Telephone No.: "Central 4407."

Messrs. Jas. Milne, Cooper & Co., Ltd., announce that as from January 1st their office and works address will be changed to Kobar Works, Ambler Street, Bradford, where they will have larger premises to cope with increasing business.

Engineering Supplies, Ltd., has removed to 235a, Blackfriars Road, London, S.E.1. New telephone no.: "Hop 6933."

The Economic Electric Co. has opened additional premises at 29, Bridge Street, Warrington.

The British Thomson-Houston Co., Ltd., has opened new premises at 53, Pitt Street, Glasgow. These comprise warehouse, offices, and stores. The principal showroom on the ground floor is a large and well-arranged apartment.

Messrs. Carrington & Button, electrical engineers and wireless dealers, have opened new showroom premises at High Street, Crewe.

Mr. Edward Bushen, for many years manager, has acquired the business of Messrs. Garnish, Lemon & Co., Ltd., electrical engineers, of Pilton Street, Barnstaple.

Messrs. Penny & Porter, Ltd., have opened showrooms for electrical and wireless goods at Broadgate, Lincoln.

All communications for Bull Motors, Ltd., should now be addressed to Quadling Street, Ipswich, the firm having removed from Stowmarket as stated last week. Telephone No.: "Ipswich 915." Telegrams: "Gippeswyk, Ipswich."

Messrs. H. C. Tofield, Ltd., have removed their works from Temple Passage, Birmingham, to larger premises at 10, Newmarket Street, where they will produce an increased output of "Siren" receivers. The offices and wholesale warehouse remain at 30, Church Street, Birmingham, and all communications should be sent there.

Catalogues and Lists.—The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Installation Leaflet No. P.3,455, illustrating and describing extensions recently carried out at the Stoke Newington electricity supply undertaking. Also Booklet No. 3,515, containing a number of suggestions with regard to electrical Christmas gifts.

Messrs. W. T. Glover & Co., Ltd., Trafford Park, Manchester.—List No. 20, containing specifications and prices of c.t.s. cables of all sizes and types.

Messrs. J. & W. B. Smith, Ltd., 15-23, Farringdon Road, E.C.1.—A price list of electrical accessories in pocket-book form. The list includes switchgear, wiring materials, cables, &c.

Messrs. Leslie Dixon & Co., 9, Colonial Avenue, Minories, E.1.—A well-illustrated catalogue of radio apparatus of all kinds, including valves, battery-chargers, instruments, &c., and a separate price list.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C.4.—An illustrated and priced sheet advertising glassware for decorative electric lighting.

Swedish General Electric, Ltd., 5, Chancery Lane, W.C.2.—Stock List No. 115, containing particulars of a.c. and d.c. motors and starters. Fully priced.

Messrs. Girlings, Ltd., Electricity Works, Maldon, Essex.—An illustrated and priced pamphlet dealing with "Mosaic" electric fires.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—December list of dynamos and motors in stock.

Mr. A. L. Curtis, Westmoor Laboratory, Chatteris.—24 pp. catalogue of tested sands for every variety of industrial purposes.

The Orbito Co., Ltd., 10, Vyse Street, Manchester.—An illustrated folder describing the "Orbito" lamp lock and shade carrier.

Messrs. R. H. Longbotham & Co., Ltd., 22, Northumberland Avenue, W.C.2.—An illustrated and priced booklet dealing with "Inventum" electric fires.

The Riley Stoker Co., Ltd., Palace Chambers, Bridge Street, S.W.1.—An illustrated brochure dealing with the "Harrington" stoker with suspended tile roof.

Dugdill's Patents, Hazel Grove, Stockport.—A mailing card bearing numerous illustrations of the firm's jointed lighting fittings of various types.

MESSRS. WARD & GOLDSTONE, LTD., Frederick Road, Pendleton, Manchester.—A series of five coloured showcards dealing with the company's "Goltone" crystal set, micrometer coil holder, l.f. transformer, the "Easifix" wiring assembly, and the "Sampson" accumulator carrier. Priced.

MESSRS. BASTIAN & ALLEN, 58, Haymarket, S.W.1.—Two illustrated pamphlets describing the "Rex" stove and the "Bastian" electric storage geyser.

Calendars and Diaries.—MESSRS. BRUCE PEEBLES & CO., LTD., of Edinburgh, have forwarded a set of renewal monthly date cards for 1925 for their calendar.

The HART ACCUMULATOR CO., LTD., of Marshgate Lane, Stratford, E.15, is distributing among its friends as usual one of its handy desk blotting pads with a calendar for 1925 conveniently printed on each sheet.

An excellent little pocket-book has been received from MESSRS. FRANCIS POLDEN & CO., LTD. This has a "three-days-to-a-page" diary, in addition to memoranda pages, and a great deal of useful information. The diary is bound in attractive blue leatherette.

From MESSRS. MATHER BROS. we have received a calendar with monthly slips and a humorous illustration of a stout tourist in an unenviable situation.

Book Notices.—"Some Magnetic Properties of Materials Used for Galvanometer Suspended Systems." Research carried out by Mr. George Williamson, B.Sc., for the British Scientific Instrument Research Association. Pp. 66; 26 figs. London: The Association. Price 6s. net.—This is the record of an exhaustive research, in the course of which the author examined all the components of a galvanometer moving-coil in turn, to identify the causes of changes in zero following on deflections of the coil, and to ascertain how these troublesome magnetic influences could be removed. Testing a "bad" coil, he found that every constituent of the suspended system contributed to its magnetic properties, in approximately the following proportions: Wooden former, 18 per cent.; silk, 33 per cent.; silver wire, mirror, &c., 49 per cent. It appeared that only a few compounds containing iron were appreciably magnetic. The wooden formers could be put right by exposure to hydrochloric acid gas. Silver wire could be improved by heating in concentrated hydrochloric acid, but much of the effect was due to magnetic material in the mass of the wire; this could be made negligible by heating the wire to bright red heat in oxygen. Copper wire was similarly cured by heating in hydrogen. Silk was the most difficult constituent; some improvement could be made by the action of hydrochloric acid in solution. Treatment of the silk in an induction furnace, by which it was hoped to produce local heating of the ferromagnetic material without rise of temperature of the silk, was successful in reducing the permanent magnetism materially.

"Your First Steps in Wireless," by H. S. Pocock. Pp. 60; figs. 25. Price 9d.; "A Four-Valve Combination Receiver," by W. James. Pp. 8; 4 figs. and 2 diagrams. London: The Wireless Press, Ltd. Price 2s.

"Friction Clutches," by R. Waring-Brown. Pp. viii+124; figs. 77. Price 5s. net. "Electric Lighting and Power Distribution," by W. P. Maycock. Eighth edition. Revised by C. H. Yeaman. Vol. II. London: Sir Isaac Pitman & Sons, Ltd. Price 10s. 6d. net.

Electricity in Nigerian Tin Mines.—At the annual meeting of the Northern Nigeria (Bauchi) Tin Mines, Ltd., on December 11th, the Chairman (Mr. G. T. Harris) explained why it had been necessary to pass the preference dividend. He said that the power installation at the mines was not by any means completed, and the lack of funds had led to heavy borrowing of money which it was desirable to repay. The work upon the Kwall Falls plant had been delayed by the non-delivery of plant, but it was hoped to have it running next September. The construction of the dam had been commenced, and the greater part of the penstock was in position. A 200-h.p. Campbell engine was nearly completed.

Export Credits for India.—The question of the extension of the Export Credits Scheme to India, Ceylon, the Straits Settlements, and Hong Kong has lately been under consideration in consultation with the interests concerned. As regards short-term commercial business, the Board of Trade does not consider it necessary or desirable to modify the existing practice under which credits are not granted for such businesses, since adequate financial facilities are obtainable through the banks. The Board has, however, decided to authorise the Exports Credits Department to consider applications for guarantees in respect of these countries in cases where long credits may be necessary in connection with contracts for engineering and similar supplies.—*Board of Trade Journal.*

British Interest in Austrian Industries.—Dispatches received from Vienna state that the British Armstrong group is taking an interest in Austrian industries, and is planning to invest large sums.

Aluminium Prices in Germany. — It is reported that the State administration of the German aluminium monopoly has made a slight reduction in prices. The new prices represent a reduction for crude aluminium of 10 centimes or 8 pfennigs per kilogramme, which is regarded in consuming circles as quite inadequate, having regard to the large increases in prices which the administration has made in recent months.

Engineering Workers' Wages.—A meeting of the trade unions concerned in the recent application for a weekly increase of 20s. in the wages of workers in the engineering industry was held at York on December 11th. The reply of the Engineering Employers' Federation was considered, and it was unanimously agreed to ask for a further meeting with the Federation in order that a reply might be given to the points raised at earlier conferences.

Czecho-Slovakian Tariff Reductions.—As a consequence of the Italo—Czecho-Slovakian commercial convention, and Great Britain's right to "most-favoured-nation" treatment, reductions are being made in the import duty on a number of articles. Included among these are dynamos, motors, transformers, rotary converters, electric locomotives, electric lamps, and cables.

Commercial Secretary for Rumania.—The address of Mr. R. J. E. Humphreys, Commercial Secretary for Rumania, is now Strada Episcopiei 6, Bucharest.

Indian Electrical Imports.—From a review of the import trade of British India for the first six months of the current fiscal year (April—September) which appeared in the *Board of Trade Journal* for December 11th, it is seen that the total value of imported electrical instruments and apparatus was Rs.89 lakhs. Of this the United Kingdom contributed Rs.60 lakhs, Germany Rs.11 lakhs, and the United States Rs.9 lakhs. "British cables still virtually control the market, but there is considerable competition from Holland and the United States in electric lamps, and from Germany in cheap fittings and accessories."

Rapid Steam Plant Erection.—A notable achievement in rapid boiler construction and installation has just been completed by Babcock & Wilcox, Ltd., for the Bath Corporation. At the beginning of last October the Electricity Department found that, unless auxiliary steam power could be provided, the works would have the greatest difficulty in coping with the rapidly increasing winter load. An order for a 25,000-lb. boiler with oil-fuel equipment was placed on October 20th with the above company, and the installation was completed by midnight on December 4th. The following day the new unit took over the town load, and is now in regular service.

Unemployment.—There was a further decrease in the number of wholly-unemployed persons during the week ended December 1st, the total at that date being 1,190,200—a decline of 390. The reduction since the commencement of the year has been 95,423.

Arbitration in Municipal Contracts.—On January 9th a conference is to be held in London between representatives of the Contracts Committee of the Federation of British Industries, the Association of Municipal Corporations, and the London Chamber of Commerce, with reference to the adoption of independent arbitration in municipal contracts and a modification of the "open" contract condition in tender forms. Draft clauses, already jointly approved, will come under further consideration.

A Siemens Trade Agreement.—The *Financial Times* states that as a result of inquiries made at the offices of Siemens Bros. & Co., Ltd., it has ascertained that the recent special issue of preference shares was made wholly in connection with a trade agreement, the aim of which is to stabilise and extend a branch of the company's business, which will require further buildings for the anticipated expansion in trade arising therefrom. "The particular branch of the business concerned cannot be revealed, nor is it possible to give any details of the trade agreement." "It was not possible to invite existing shareholders to participate in the issue, as the sale of the shares was a condition of the trade agreement."

Lead. — Messrs. James Forster & Co., in reporting on December 13th, state:—"It is difficult to account for such an abnormal advance in the price of lead as 52s. 6d. per ton in a week. The chief causes are, speculative buying in anticipation of a boom in trade next year, a certain amount of 'short' covering, moderate buying by consumers for early delivery and the advance in the American price from 8.65 to 9 cents per lb. This latter factor has a sentimental effect only, as the American price of drawback lead is £9 per ton. below the London parity, so that there is no chance yet awhile of America taking supplies from Mexico or Europe. Indeed, with a further advance here and no corresponding advance in the States, we might even see American domestic lead shipped to Europe. Taking supply and demand, the position at present seems to be sound enough, the latter exceeding the former, but this week's advance appears to us to have been rather overdone."

The Anglo-German Commercial Treaty.—In a recent issue of *British Industries* (the official organ of the F.B.I.) an article appeared on this subject. The German reservation of the right to impose heavy import duties is regarded as preferable to the virtual prohibition which has existed under the licensing system. It is considered that if it is carried out in accordance with the spirit of the protocol attached to it, the treaty will be beneficial to this country. The Federation has contributed in no small measure to the framing of the convention, and once again it has been proved that consultation with industry through its representative institutions is beneficial in these international matters.

New French Company. — A new undertaking has lately been formed in Paris (73, Boulevard Haussmann), with a capital of 13 million francs and the title La Société Union Financière pour l'Industrie Electrique.

Alleged Unfair Competition.—We have had many cases brought before us at different times in which electrical contractors and factors have accused manufacturers of having entered into unfair competition with them by allowing full trade discounts to their retail customers. This subject periodically arises in our "Correspondence" section as it relates to a practice which causes chaos and ill-feeling and makes satisfactory business practically an impossibility. If we are to have a body of retailers who are to be financially stable there ought to be confidence between the manufacturer and the retailer. Sometimes worse accusations than the above are brought against manufacturers, as our pages have shown. The latest to reach us, if the facts be as reported to us, is not only reprehensible but almost unbelievable and one calling for explanation. We are informed by an electrical contracting firm that one of their clients requested them to give a demonstration of various makes of a certain domestic appliance. The contractors arranged for a demonstration to take place on a certain day. Two days prior to the date fixed, the representative of one of the makers called upon them and informed them that they could not purchase a machine direct, but only through their local agents, with whom they would be obliged to split the discount. Immediately after giving them this information, the said representative, with the local agent's man, called upon their client, gave a demonstration, sold and left the appliance. No representative of the contracting firm was present and they were unaware of the deal. The said makers' representative telephoned them later in the day and coolly informed them of this unique method of conducting business.

Perhaps if other readers are experiencing the same sort of "competition" they will communicate the facts to us, as if this is to be regarded as normal practice on the part of particular firms it is as well that the trade generally should know it.

New Municipal Showrooms.—The Corporation of Blackburn inaugurated new electricity showrooms on December 13th. These showrooms are in the central thoroughfare of Darwen Street and consist of a shop, drawing room, dining room, and kitchen, all equipped with the most modern electrical appliances. There was a large gathering at the opening by the Mayor (Councillor Standworth, J.P.). Alderman C. Higham, chairman of the Electricity Committee, said that the object of the showrooms was not to make profit for the Corporation out of actual sales, but to bring before the public the many uses of electricity. For instance, in wiring the premises, a large sum had been spent by the British Insulated and Helsby Cables, Ltd., simply to advertise its system of wiring. Most of the goods had been sent by firms, not for sale, but to advertise their goods.

The Liverpool Corporation is to spend £8,000 on equipment for the new electricity showrooms in Whitechapel.

Glasgow Corporation Electricity Committee has purchased property in Sauchiehall Street required for additional showroom accommodation.

Institution of the Rubber Industry.—The newly-formed London and District Section of this Institution held its first dance at the Wharncliffe Rooms, London, on Friday last. Over 200 members and friends were present and amongst these were Sir Stanley Bois, President of the Institution, Sir Henry Wickham, Mr. H. Eric Miller, Chairman of the Rubber Growers' Association, Mr. D. F. L. Zorn, Chairman of the Council of the Institution of the Rubber Industry, and Mr. J. H. C. Brooking, who acted as M.C. This dance was more successful than any other similar function held by the Institution.

Proposed Metal Industry Trust.—According to the Berlin correspondent of the *Echo de Paris*, the negotiations which have been going on in Paris between French and German representatives of the metal industry have resulted in the temporary abandonment of the scheme for a Franco-German trust. A decision is said to have been come to to set up a European combination embracing Great Britain, Luxemburg, Czecho-Slovakia, and Poland.—*Reuter* (Paris).

An Important Japanese Contract.—A contract for the purchase of power-plant machinery and equipment, valued at more than $1,000,000 (gold), has recently been signed by the Nippon Denryoku Kabushiki Kaisha (Japan Electric Power Co.) of Osaka, Japan. The Escher-Wyss Co. will supply the turbines and condensers, Siemens-Schuckert Co. has been awarded the contract for building the generators, and Babcock and Wilcox (through Mitsui & Co.) will build the boilers. The motors necessary to operate the auxiliary pumps are to be built by an American firm. The prices quoted by American companies were approximately 40 per cent. higher than those quoted by foreign competitors. The terms of credit granted on these orders will cover a period of three years.—*Commerce Reports.*

C.S. "Faraday."—We learn that Messrs. Siemens Bros. and Co.'s C.S. *Faraday* left the company's works at Woolwich last Saturday afternoon loaded with 1,500 miles of submarine cable to be laid for the new Italian cable company between Cape Verde Islands and the Island of Fernando Noronha, a small island off the coast of Brazil. Messrs. Siemens Bros. and Co., Ltd., are, we understand, now actively engaged in the manufacture of 1,700 miles of cable to form the continuation of this Italian company's system from Fernando Noronha south to Rio de Janeiro.

L.M.S. Railway Improvements.—The London, Midland and Scottish Railway Co. has sent us a review of a large programme of improvements, involving an expenditure of £14,000,000, which it is putting in hand immediately. The work includes a large number of new coaches, all of which will be electrically lighted, new kitchen cars, new locomotives, improved facilities at Holyhead, and station reconstruction.

London Lighting Fitting Showrooms.—Messrs. Falk, Stadelman, Ltd., Farringdon Road, E.C., have a very large stock of electric lighting fittings of practically every type available, and many of these are displayed in their showrooms to which we recently paid a visit. The artistic glassware in the form of bowls and shades is a very striking feature of the collection, the moulding and colouring being excellently carried out in a variety of ways. Many examples of electroliers, which are said to be coming into fashion again, are present, there being some well-executed metal work among these. Metal and wooden standards, floor and table, are exhibited, as well as shades, statuettes in French bronze and gilt finishes, reading desk fittings, &c. One section of the showrooms is devoted to radio apparatus of the company's manufacture, and in addition to components and accessories, there are receiving sets ranging from a cheap crystal set to an elaborate oak cabinet with a 5-valve set and loud speaker incorporated in it. Domestic appliances, as "Radiolectric" fires, irons, kettles, &c., are also on view.

Wembley Next Year: A Protest.—The Trade Exhibition Organisers' Association, of Broad Street House, E.C.2, which represents various exhibitions, passed the following resolution on November 24th, and has forwarded copies to the Prime Minister, to the President of the Board of Trade, and to members of Parliament:—

"That this Association regards with apprehension the growing tendency of Government Departments to be associated in the organisation and financing of exhibitions purporting to fulfil functions similar to those which have for many years been served by exhibitions promoted by members of this Association, and in particular views with alarm the present Government's avowed intention to guarantee £1,000,000 for the purpose of continuing the British Empire Exhibition for another year, and a further £400,000 for guaranteeing the expenses of the Dominions in connection with the Exhibition. The Association feels that in thus renewing its support in what was to have been an isolated exhibition, the Government is definitely taking part in commercial enterprise in competition with members of this Association."

British Trade Mark Applications. — The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned. In the case of foreign applications, the names and addresses of the British representatives are also given.

Fansteel Balklite. No. 448,778. Class 8. Current rectifiers and lightning arresters.—Fansteel Products Co., Inc., Sheridan Road, North Chicago, Ill., U.S.A. (White, Langner, Stevens and Parry, Jessels Chambers, 88-90, Chancery Lane, London, W.C.2). December 3rd, 1924.

Robins Electrical and Wireless Depôt and Institute, Ltd. (lettering and design). No. 448,575. Class 8. Electrical and allied instruments and apparatus, &c.—Robins Electrical and Wireless Depôt and Institute, Ltd., 8a, Fanny Street, Cathays, Cardiff. December 3rd, 1924.

Silvertown Radio Components (lettering and design). No. 449,807. Class 8. Apparatus for wireless telegraphy and telephony.—The India Rubber, Gutta Percha and Telegraph Works Co., Ltd., 106, Cannon Street, London, E.C.4. December 3rd, 1924.

Ericsson (lettering and design). No. 450,080. Class 8. Telephones, electrical switchboards, loud speakers, and wireless telephonic and telegraphic receiving and transmitting sets and parts thereof.—The British L.M. Ericsson Manufacturing Co., Ltd., International Buildings, 67-73, Kingsway, London, W.C.2. December 3rd, 1924.

Thermoformer (lettering and design). No. 450,198. Class 8. Electrical apparatus for use in wireless telegraphy and telephony, for supplying electrical energy from electric lighting circuits to thermionic valves or tubes.—The Sabin Electrical Products Corporation, 15, Exchange Place, Jersey City, N.J., U.S.A. (Feeny & Feeny, 73a, Queen Victoria Street, London, E.C.4). December 3rd, 1924.

Amplion (lettering and design). No. 451,457; and Dragon (lettering and design). No. 451,459. Class 8. Loud speakers.—Edward Alfred Graham, trading as Alfred Graham and Co., St. Andrew's Works, Crofton Park Road, London, S.E.4. December 3rd, 1924.

Armax. No. 451,894. All goods included in Class 8, but not including electric batteries, electric cells, and thermionic valves or goods of a like nature.—Armax, Ltd., Byron House, 2, Finsbury Street, London, E.C.1. December 3rd, 1924.

Ledion. No. 452,008. Class 8. Instruments and apparatus for use in wireless telephony and telegraphy.—The firm trading as L. E. Douse, 43, Johnson Street, London, S.W.1. December 3rd, 1924.

Olophor. No. 452,762. All goods included in Class 8. Contessa-Nettel Gesellschaft, 5, Dornaldenstrasse, Stuttgart, Germany (Marks & Clerk, 57-58, Lincoln's Inn Fields, London, W.C.2). December 3rd, 1924.

Norwegian Locomotive Orders. — It is announced from Christiania that an order has just been placed with a syndicate consisting of Thunes & Hamar, Brown, Boveri and Per Kure, Christiania, Siemens-Schuckert and the A.E.G. for the delivery of nine electric locomotives for the Christiania-Lillestrom railway, which is now under conversion from steam to electric traction. The prices quoted by the syndicate to the State Railway Administration were within the limit of 15 per cent., which is preferentially given in Norway for work carried out in that country. The motors will be constructed by Brown, Boveri, the transformers by Per Kure, and the apparatus by the Norwegian branches of the German firms mentioned.

Russian Notes.—*Transformers from Sweden.* — The managers of the Volkhov station are reported to have received information that M. Graftio, engineer, has placed orders in Sweden for the delivery of 18 transformers and other electrical equipment for this hydro-electric works.

Swedish Technical Assistance.—Swedish technical assistance was secured a short time ago by the Soviet authorities in connection with the Volhov hydro-electric works. Now it is announced that Mr. B. G. Hornell, of the Swedish State Hydro-electric Construction Bureau, has just returned from Russia, where he has made a study of certain hydro-electric installations on behalf of the Bureau, whose opinion has been asked by the competent Soviet authorities upon certain hydro-electric technical problems.

High-Pressure Transformers.—The trial took place on November 18th, at the Dynamo Works, Petrograd, of the first transformer constructed in Russia for 120,000 V. The tests, which were carried out in the presence of representatives of technical educational institutions and of specialists, are said to have yielded very favourable results.

Electrical Exhibition.—The General Electrical Commission is organising an "electrification" exhibition in celebration of the fifth anniversary next year of the adoption of the scheme of electrification for Russia. Invitations are being sent to all the organisations and trusts concerned with electrical works to participate in the exhibition.

Proposed Norwegian Electrical Bank. — The Norwegian Association of Private Power Stations has come forward with a definite opinion concerning the proposal of the State Electricity Supply Commission in favour of the establishment of an electricity bank. Having regard to the many unsuccessful communal electricity works, the Association states that this represents a proof that the communes should not be provided with easier facilities for the institution of electricity supply works. It is submitted that the taxpayers in general should not be burdened with the losses of individual communal electricity works as is proposed by the draft law prepared by the Commission, but that each undertaking should be made to defray its own expenses. In conclusion, the Association says that it seems that if established, the bank will become a politically managed institution with but little guarantee that it will be carried on as a business undertaking, and that the bank will be unable to prevent the promotion of schemes which will prove to result in a loss.

Social Events.—The Athletic Club of the Wakefield depôt of the Yorkshire (West Riding) Electric Tramways Company, Ltd., held a supper and dance last week at the Assembly Rooms. There was a large company present, and the affair was carried through in a manner reflecting great credit on the secretary, Mr. E. H. Hare.

To celebrate the 25th anniversary of the establishment of the business, Mr. Oswald Jones, electrical engineer, of Maidstone, entertained his staff to a dinner and musical evening on November 29th. During the proceedings Mr. Jones was presented with an inscribed silver cigarette case.

The County of London Electric Supply Co.'s Social Society is holding a fancy dress carnival and dance at the Cannon Street Hotel to-night (Friday).

For Sale.—Plymouth Corporation Electricity Department has for disposal six Lancashire boilers and fittings. York Corporation Electricity Department invites offers for one 1,250-kW B.T.H. 3-phase turbo-generator with Worthington condenser. Bristol Corporation Electricity Department has for disposal a number of continuously rated d.c. motors. The Officer-in-Charge, Royal Engineers' Stores, Shoeburyness, invites offers for surplus electrical stores, including motors, transformers, &c. (See our advertisement pages to-day.)

Poland's Electrical Imports.—According to the *Board of Trade Journal*, the value of instruments, conductors, and other electrotechnical apparatus imported into Poland during June last was 1,561,000 zloty (about £63,700).

Comprehensive Insurance.—The National Alliance of Employers and Employed, through its various committees, has had the subject of comprehensive insurance for the working classes under consideration for some time, and at a meeting of its Executive Committee held last week, presided over by Sir Edward Manville, when representatives of Employers and trade unions from all parts of the country were present, the following resolution was passed:—"That the Executive Committee of the National Alliance of Employers and Employed is of opinion that the principle of an all-in insurance scheme, comprising sickness, unemployment, old age, widows and dependants, should be examined, and prays the Government to set up a committee (composed of members of Parliament and representatives of the various other interests concerned) to examine, and report on the desirability and practicability of the institution of such a scheme." The Executive Committee of the Alliance is further requesting the Prime Minister to receive a deputation.

Copper and Lead Prices.—Messrs. F. Smith & Co. report December 16th:—Copper (electrolytic) bars, £70 10s., £2 increase; do. do. sheets, no change; do. do. wire rods, £80 10s., £2 increase; do. do. h.c. wire, 10 1-16d., 5-16d. increase.

Messrs. James & Shakespeare report December 17th:—Copper (best selected) bars, sheet and rod, £96, £1 increase; English pig lead, £44, £3 5s. increase.

Application for Patent Extension.—Mr. G. F. Allom, of 15, George Street, Hanover Square, is applying to the High Court for an Order for the extension of Letters Patent No. 6,836 of 1909 for "Improvements in electric lighting reflectors for concentrating light."

Prague Electric Railway Tenders.—The result of the tendering for the Prague electric railway scheme showed that Czecho-Slovakian firms were able to underbid all their foreign competitors. German, American, Swiss, Italian, and English (Vickers) firms were represented, but their quotations were considerably higher. For instance, for a passenger locomotive the Böhmisch Mahrisch Co.'s offer was 2,204,000 Czech crowns, compared with that of the A.E.G., Berlin, of 2,800,000 crowns, and the Oerlikon Co., 2,350,000 crowns. For the overhead network the home firms' tenders ranged from 9,500,000 to 14,500,000 crowns, whereas the A.E.G., Berlin, quoted 20,661,000 crowns. It has been stated that the mere statement of figures is misleading, as the details of what was actually offered in each case are not disclosed.

Threatened Engineering Lock-out in Belgium.—The Commercial Secretary at Brussels (Mr. J. Picton Bagge) has informed the Department of Overseas Trade that the *Independence Belge* recently reported that in order to put an end to the series of small strikes which have been taking place recently, the Constructional Engineering Federation had decided, that should these strikes continue, a general lock-out would be proclaimed in Brabant on December 14th, and in the entire country on December 22nd.

An Electrical Service Bureau. — A new electrical bureau has been opened in Castle Circus, Torquay, by the Corporation. Attached to the bureau is a model kitchen provided with every modern electrical device for the simplification of household work.

Merchandise Marks.—The Director of the Federation of British Industries has written to the President of the Board of Trade urging the early adoption of the unanimous recommendations of the Merchandise Marks Committee which reported in June, 1920. It is considered that there can be no serious argument against the desirability of enabling the British public to distinguish goods of foreign manufacture, and thus giving them the opportunity of buying British articles if they prefer to do so.

The Prague Spring Fair.—The Commercial Secretary at Prague (Mr. Alexander A. Adams) has forwarded to the Department of Overseas Trade a copy of a leaflet issued by the management of the Prague International Fair, which states that it has decided to organise a radio exhibition within the Prague Spring Fair to be held from March 22nd to 29th, 1925. The management has secured the support of the Association of the Radio-Electric Industry, the Association of Radio Accessories Merchants, and the Broadcasting Company "Radiojournal." A congress of radio amateurs will also be held in Prague during the same period. Further particulars can be had from the Department or the management of the Fair, Staromestska Radnice, Prague I.

A Lamp Factory in Budapest Closed.—Our Austrian correspondent writes as follows:—"The Just Electric Incandescent Lamp Factory in Budapest was closed on December 1st. It dismissed all its staff of about 2,000 workmen, and gave notice to its officials. The factory had stood outside the cartel of the European incandescent lamp factories, and sold its product 10 to 15 per cent. cheaper than the others. The cartel did its best to defeat its operations. Some weeks ago a foreign trust secured a majority of the shares, and it has now closed the factory."

German Activity in Spain.—The F.B.I. Commissioner in Madrid has written a communication, which is printed in *British Industries* for December 9th, on "Spain Under the Directorate: Desire for British Aid in Development Work." He closes his comments with these words:—"The Germans are showing the greatest activity and interest in every aspect of Spanish industry, and those Spanish industrialists who understand that, in order to perfect their methods of production, they still need aid and technical experience, turn with gratitude to the German for the simple reason that there is a lack of collaboration in other directions. Why should not British capital and industry enter the arena? If they decided to do so I have not the slightest doubt as to the result. But there is no time to be lost. In this case the 'race is to the swift'; to obtain a share in the Spanish markets is of urgent importance to British industry and the moment is opportune."

Hydraulic Power Exhibition at Grenoble.—The United Kingdom representative for this exhibition, which, as recently stated, is to be held from May to October next year, is M. Paul Dieny, 20-21, Laurence Pountney Lane, E.C.4.

Lighting and Power Notes.

Aylesbury.—SPECIAL ORDER.—The Town Council is applying for a Special Order to supply electricity in an area comprising 232 square miles. The scheme covers a considerable part of the county of Buckingham and also parts of Oxfordshire and Hertfordshire. The estimated cost is £53,000.

Barnes.—ELECTRICITY SUPPLY.—The Electricity Committee has recommended to the Urban District Council that a further contract be entered into with Messrs. Watney, Combe, Reid & Co., Ltd., for an additional supply of electricity to Mortlake Brewery, and that application be made for sanction to borrow £3,000 to cover the portion of the cost of the scheme to be borne by the Council.

Blackburn.—ELECTRICITY SUPPLY.—The Town Council has appointed a special committee to meet representatives of the Lancashire Electric Power Co. to consider questions relating to the supply of electricity in the supply areas of the Corporation and the company. Applications for supplies to the districts of Hoghton and Pleasington have been deferred by the Blackburn authority for the present.

Bradford.—LOANS.—The Electricity Committee recommends the City Council to sanction further expenditure on mains, &c., up to a total of £20,000. Sanction has been received to the borrowing of £17,948 in respect of the erection and equipment of the Four Lane Ends sub-station, towards which the Unemployed Grants Committee has agreed to contribute part of the interest on the loan.

Chesterfield.—ELECTRICITY CHARGES.—The Town Council has decided to introduce an alternative to the present charges for lighting, heating, cooking, &c. The alternative tariff is a minimum fixed charge of 20 per cent. per annum of the net rateable value of a house, and 1½d. per kWh for all electricity used.

Clitheroe.—ELECTRICITY SUPPLY.—The Town Council has applied for a Special Order for the supply of electricity in the borough and in the adjoining districts of Mearley, Twiston, Worston, Chatburn and Downham. A bulk supply will be obtained from the Lancashire Power Co.

Continental.—ITALY.—The Società Industriale Elettrica del Mugello has obtained a concession to set up a 20,000-kW generating plant in the province of Florence for the recovery of chemical by-products. The Government will grant a subsidy of 600,000 lire yearly.

BELGIUM.—A new Bill for the extension of electricity supply throughout Belgium is at present before the Belgian Senate. The Bill lays down new regulations with regard to electrical distribution and to the interconnection of the mains of different power stations with the object of equalising the load.

SWITZERLAND.—A scheme is under consideration for the construction of a hydro-electric station at Massagno, near Lugano, in the Canton of Ticino to utilise the power of the River Cassarate. The plant is estimated to cost 520,000 Swiss francs.

Dewsbury.—ELECTRICITY EXTENSIONS.—The Town Council has approved a scheme for mains extensions in the Boothroyd Lane district at an estimated cost of £2,152, and application is to be made to the Unemployment Grants Committee for a grant. A further scheme for mains extensions at Earlsheaton, at an estimated cost of £1,400, has also been approved.

Doncaster.—ELECTRICITY CHARGES.—The Town Council has decided to supply electricity for domestic purposes upon payment of a fixed rental of 15 per cent. per annum on the net rateable value of the house, plus 1d. per kWh from April to September, and 1½d. per kWh from October to March. The new tariff is an alternative to the present flat rate, and will come into force in April next.

Greenock.—INTERLINKING.—With reference to the note in our issue of December 12th under this heading, Mr. E. T. Goslin, general manager of the Clyde Valley Electrical Power Co., informs us that the company has entered into an agreement whereby it receives a bulk supply from the generating stations of the Corporation of Greenock and the Ayrshire Electricity Joint Board for distribution in a portion of the company's area, including a bulk supply to the burgh of Paisley. The former note made no mention of the company's share in the agreement.

Halifax.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer: Mr. W. M. Rogerson) for the year ended March 31st last, record a total revenue of £177,538, as compared with £161,673 in the preceding year. Working expenses totalled £90,072, as against £85,615, leaving a gross profit of £87,466 (£76,058), to which was added interest on investments, making a total of £91,318. After deducting capital charges, &c., there was a net surplus of £32,596, as compared with £27,069 in 1922-23, of which £7,005 was contributed to the borough fund. The capital expenditure during the year amounted to £63,460, the chief items being £31,845 for boiler plant and £13,518 for mains and services. The sales of electrical energy increased from 19,849,432 to 21,367,440 kWh, and the maximum supply demanded rose from 10,255 to 11,150 kW.

Hazel Grove and Bramhall.—ELECTRICITY ORDER.—The Urban District Council is applying for an Order to supply electricity to the parishes of Woodford and Poynton.

Irish Free State.—THE SHANNON SCHEME.—It is now announced that the Irish Free State Government has decided to sanction the scheme submitted by Messrs. Siemens, Berlin, for the harnessing of the River Shannon, and the four Continental experts whose advice was sought are in Dublin drafting a report chiefly on the application of the scheme. A loan for the execution of the works will be sought.

ELECTRICITY BILLS.—The Joint Committee of the two Houses of the Irish Free State Parliament, appointed to consider and report on the three Bills submitted for the harnessing of the River Liffey for electrical development has opened an inquiry into the schemes. The Bills are: The East Leinster Electricity Supply Bill, the Dublin Electrical Supply Bill, and the Dublin and District Electricity Supply Bill, the first and second being promoted by private interests and the last by the Dublin Corporation. Of the three schemes, the East Leinster proposes to supply the largest area, which includes the city and county of Dublin and large portions of counties Kildare and Wicklow. Power stations would be erected at Ballymore-Eustace and Leixlip.

Mr. Jellett, K.C., said the capital, fixed at £1,300,000, was forthcoming, and powers were taken to increase it to £1,500,000. Dr. J. Crowley was examined on behalf of the promoters, and said the scheme should be linked up with the proposed Shannon scheme.

The promoters of the Dublin Electricity Supply Bill opposed the East Leinster scheme, representing that their scheme was a better one and more suitable, and that it would give a cheaper supply at an early date, and would effectually cover the whole watershed. Further, they urged that the East Leinster scheme purchase clause was illusory and ineffective, that the estimate of expense was insufficient, and that there would be unnecessary interference with existing rights. In support of the opposition, Sir John P. Griffith said that he favoured the plan of several power stations. Col. Claude Cane opposed the proposal to erect a dam at Leixlip, holding that it would result in the killing of the salmon in the Liffey.

Serjeant Hanna, K.C., for the promoters of the Dublin Electricity Bill, said that the East Leinster Bill was both technically and financially inadequate.

When the Dublin Electricity Supply Bill came up for consideration, Sir J. P. Griffith stated that it was proposed to have the Liffey developed and utilised before the Shannon scheme came along. The order of development would be first at Poulaphouca and then at Golden Falls and Leixlip. The capital contemplated was £1,200,000, capable of being increased to an amount not exceeding £2,000,000. In the Bill borrowing powers were provided for. It was proposed to give the State a favourable option on the purchase of the works.

The sittings of the Committe were to be continued this week, and will probably extend to next week.

London.—BATTERSEA.—To permit of the development of the generating station, the Electricity Committee has recommended that the premises adjoining the station be acquired at a cost of £10,000.

STEPNEY.—The Finance Committee has recommended to the Borough Council that the following scheme for additions and new plant submitted by the Electricity Committee be approved:—(1) One 1,500- to 2,000-kW converter, with switchgear (£9,250); (2) extension to Lomas Street sub-station building (£13,000); (3) one 1,000-kW converter at Limehouse sub-station (£5,250); (4) one 1,000-kW converter at Wapping sub-station (£5,250).

Luton.—ELECTRICITY ORDER.—The Electricity Commissioners have made an order authorising the Corporation to supply electricity in the following districts:—The borough of Dunstable; the urban districts of Leighton Buzzard and Linslade; the rural districts of Luton, Eaton Bray, and Wing; and certain parishes in the rural district of Hemel Hempstead.

Lytham-St. Annes.—LOAN SANCTIONED.—Sanction has been received to the borrowing of £7,790 for duplicating the main feeder cable from Blackpool.

Middlesbrough.—LOAN.—The Corporation is applying for sanction to the borrowing of £32,000 for mains, services and meters during the ensuing two years.

Morocco.—ELECTRICITY SCHEMES.—A comprehensive programme has been prepared for the supply of electricity in Morocco. A steam generating station is now being erected in the suburbs of Casablanca, which is expected to be completed by the end of this year. The plant will consist of two 2,000-kW turbo-alternators. A hydro-electric station is to be constructed at Si-Said-Maihen, on the River Oumm-el-Rebia, with a capacity of 20,000 kW.

Paisley.—LOAN.—The Corporation is applying for sanction to borrow £33,190 for further extensions of the distribution plant and for street lighting.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

BUXTON.—Lighting: Below 200 kWh per quarter, 7d. per kWh; 200 to 1,000 kWh, 6d.; 2,000 kWh and over, 5d.

Heating, domestic appliances, &c., 2d. per kWh. Power, 2d. per kWh.

MENAI BRIDGE.—Lighting: From 1s. to 10d. per kWh. Power: From 6d. to 5d. per kWh.

Redcar.—LOAN SANCTIONED.—The Town Council has received sanction to the borrowing of £5,160 for extending its electricity supply to its new housing estates.

Rugby.—INQUIRY.—Mr. O. A. Sherrard, of the Ministry of Transport, recently held an inquiry at Leamington into the application of the Leicestershire and Warwickshire Electric Power Co., for consent to erect an overhead transmission line across agricultural land between Warwick and Rugby to supply energy to the Government wireless station and other undertakings. For the company, it was stated that the voltage would be 30,000, and the line would ultimately be extended from Rugby to link up with the company's power station at Hinckley. If the line were erected by the main roads it would involve an additional annual charge of £5,800. The application was opposed by the owners of the land over which the line would pass, on the ground that the erection of poles would seriously affect the cultivation of land. At the conclusion of the inquiry the inspector visited the farms affected.

Sheffield.—ELECTRICITY EXTENSIONS.—The Electric Supply Committee has approved extensions and works costing £6,911. Extensions of mains, at a cost of £13,598, have also been approved.

HIRE-PURCHASE SYSTEM.—The City Council has approved the proposal of the Electricity Committee to electrically equip houses on the hire-purchase system.

Special Orders.—The Electricity Commissioners have submitted the following Special Orders to the Ministry of Transport for confirmation:—Brighton Corporation, for supply in the urban district of Portslade-by-Sea; Bredbury and Romiley Council, for supply in the urban district.

Sunderland.—LOANS SANCTIONED.—The Corporation has received sanction to borrow £6,000 for services and £15,000 for mains.

Sutton Coldfield.—EXTENSION OF SUPPLY.—The Corporation proposes to extend its area of electricity supply to the Streetly and Little Aston districts, and is applying for sanction to the borrowing of £12,388 to carry out the scheme.

United States.—ELECTRICITY SCHEME.—According to *Power* a steam generating station is to be constructed at Avon, Ohio, by a subsidiary of the North American Co., which will have a capacity of 400,000 h.p. The estimated cost of the scheme is $30,000,000.

Venezuela.—HYDRO-ELECTRIC DEVELOPMENT.—It is reported that a scheme has been drawn up by the Siemens-Schuckertwerke, of Berlin, for utilising available water power in the Carnas Valley for generating electricity, and for its transmission to Caracas, a distance of 47 miles. The central power station would be erected at Cana Fistula, and three 4,200-h.p. turbines coupled to 3,600-kVA, 3-phase, 60-period alternators would be installed. Electricity would be generated at 3,150 V and stepped up to 44,000 V for transmission to Caracas, where it would be reduced to 2,300 V for distribution to sub-stations in various parts of the city.

Wakefield.—STREET LIGHTING.—The City Council has decided to reduce the percentage increase on the charges for street lighting from 87½ to 50, on the understanding that the existing gas lighting is converted to electricity.

Walton-le-Dale.—SPECIAL ORDER.—The Lancashire Electric Power Co. has applied for a Special Order authorising it to supply electricity in the urban district.

Tramway and Railway Notes.

Continental.—PORTUGAL.—It is reported from Lisbon that an application has been presented to the Portuguese Ministry of Commerce for a concession for the construction of a tunnel to connect both sides of the River Tagus by the establishment of a double line of electric railway for the transport of passengers and goods, in substitution for the existing service of ferry boats. The tunnel would have a length of 6,250 metres, and the application has been made by French promoters, who have also asked for permission to construct a railway between Barreiro and Cacilhas.

SWITZERLAND.—The electrification of the North-South main line of the Swiss Federal railways has been completed, and the authorities are devoting attention to the electrification of the main line from Basle to Buchs. A start is to be made next year with the conversion to electric traction of the Botzberg line, which it is hoped to complete by the spring of 1926. The Brugg-Richterswil section has already been electrified, and it is planned now to continue the electrification to Chur and later to Buchs, where connection will be made with the Austrian Arlberg-Vienna line, which will probably also be electrified in the near future.

DENMARK.—An English syndicate has submitted a scheme for the conversion to electric traction of the Copenhagen and suburban railways at an estimated expenditure of 12,000,000 kronen.

BAVARIA.—*The Times* states that the electrification of the railway line connecting Munch with the Bavarian Alps and Tirol *via* the Starnberg lakes will shortly be sufficiently advanced to enable the existing system to be dispensed with. It is estimated that the non-stop journey, Munich-Garmisch, a distance of 62 miles, will be covered in 1¼ hours by the electric trains, a saving of 50 minutes on the express services at present scheduled.

Darlington. — RAILLESS CARS. — The Town Council has decided upon seven additional routes for the proposed railless cars which are to replace the existing tramways. It has also been decided to incorporate in the Bill a clause which will allow further extensions to be made. The Chairman of the Tramways Committee states that it is anticipated that the railless-car system will be running by March, 1926.

Hartlepool.—PURCHASE OF TRACK.—Following negotiations between the West Hartlepool Corporation and the General Electric Tramways Co., Ltd., it has been agreed that the latter shall sell to the West Hartlepool Corporation the tramway track in the borough of Hartlepool, and all rights appertaining to it. The West Hartlepool Corporation recently made application for powers to run railless-cars over the route, and the Hartlepool Corporation is seeking powers to run motor 'buses over the same route.

London.—TUBE FARES.—It is reported that the 1½d. fares on the London Underground railways are to be reduced to 1d. as from January 1st next. The reduction does not apply to the Metropolitan Railway, which has decided to make no alteration in its fares.

NEW TRAMWAY FARE.—The London County Council has adopted a recommendation of the Highways Committee that for an experimental period of six months, shilling daily tramway tickets be introduced, available on Saturdays and Sundays on the Council's tramcars, anywhere and at any time on the day of issue.

PROPOSED NEW TRAMWAY ROUTES.—The London County Council is applying for Parliamentary powers to construct a new tramway from Southend (Catford) across Downham Estate to Grove Park and from thence to Well Hall Road, Eltham. The estimated cost of the scheme is £303,735.

Shipley.—PRICE OF ENERGY.—As a result of negotiations between the Bradford Corporation Tramways Department and the Urban District Council, on the question of the charge for electricity supplied by the Council for use on the Bradford tramways running in Shipley, the Shipley authority has agreed to reduce the price from 2½d. to 2d. per kWh as from April 1st, 1925.

South Shields.—LIGHT RAILWAY.—The Corporation Tramways Committee has approved the suggestion to take steps to apply for an Order to construct a light railway in continuation of the present light railway beginning at the borough boundary and extending to Four Lane Ends, Cleadon, and that application be made to the Unemployment Grants Committee for a grant towards the cost. The Rural Council has agreed to the proposed extension.

Sunderland.—INQUIRY.—An inquiry was held on December 5th by the Ministry of Transport into the application of Sunderland Corporation for a Light Railway Order to carry out two extensions of the tramway system—a single line in Derwent Street and a double track along Durham Road. The Town Clerk said the Durham Road extension would serve an estimated population of 6,000. The chairman of the Tramways Committee stated that an extension of the existing system was far more suitable for the route, which was only three-quarters of a mile, than a 'bus service. Mr. A. R. Dayson, tramway manager and engineer, said that the estimated cost of the Durham Road scheme was £18,096 plus overhead charges, and the estimated revenue £4,000 per annum. Several residents opposed the schemes, on the grounds that they were undesirable and would cause danger. The Inspectors intimated that the decision of the Ministry would be given in due course.

Telegraph and Telephone Notes.

Communication with Ships.—A CABLE COMPANY'S SERVICE.—In future wireless messages will be accepted by the Eastern Telegraph Co. addressed to passengers travelling in ships on the sea routes to and from Egypt, Aden, India, Ceylon, the Far East, Australia, New Zealand, Africa, and South America.

First "Beam" Station.—SITE CHOSEN.—The site for the first "beam" (short-wave directional) radio-telegraph station in the Empire chain has been chosen near Dorchester. The five stations which are to be built will be in continuous touch with similar big stations in Australia, South Africa, India, and Canada.—*Daily Mail.*

Hull Telephone Service.—NEW SCHEME.—The Hull Corporation telephone manager, Mr. Thomas Holme, is preparing a report on a scheme proposed by the Sheriff of Hull, Councillor Finn, to lay telephone wires on the same principle as water and gas pipes for Hull houses assessed at £20 a year or more. The cost would be covered by making the assessment slightly higher when the occupier wished to have a telephone. The sheriff thinks that by increasing the number of subscribers the telephone service would be cheapened. The scheme, he says, is working in Stockholm and other cities in Northern Europe. The telephone manager says that with flat-rate charges and an unrestricted service a larger system would be more expensive. Hull's present telephone charges are the cheapest in England.—*Daily Mail.*

India.—RADIO TELEGRAPHY.—Our Indian correspondent states that in the opinion of Commander R. L. Nicholson, Director of Wireless in India, the 25-kW stations at Madras and Rangoon are sufficient for the present traffic needs of India so far as internal communication is concerned, and that therefore there is no great necessity for installing further plant, though the possibility of using radio as an adjunct to land line is now examined whenever fresh telegraph facilities are required. The radio stations at Madras and Rangoon now carry a reasonable proportion of the telegraph traffic between India and Burma, using the Baudot system. In the event of airship communication with India coming into being, the Government is likely to erect a radio station, possibly at Bombay, or wherever the proposed terminus is to be, so as to enable the airships to keep in touch with India as soon as they leave Egypt.

The requirements of the Government in India as regards the Indian Imperial station are that it shall be capable of duplex communication in two directions simultaneously and be able to transmit a hundred words a minute for twenty hours a day at a charge not exceeding three-fourths of the prevailing cable rate. It will be possible in the near future for newspapers in India to receive an adequate daily summary of news from all the Dominions, instead of having to rely on the London clearing house for cable messages.

Radio Telephony.—MERSEY DOCKS.—The Postmaster-General has given authority to the Mersey Docks and Harbour Board for radio-telephonic communication to be used between the Crosby lightship and the Liverpool dock offices on the general conditions applicable to the Bar and Formby lightships for commercial and life-saving purposes, pending the granting of the necessary licence. All three Mersey lightships—the Bar, Formby, and Crosby—are now in radio-telephonic communication with the Dock Board offices.

The Telephone Service.—MANCHESTER'S AUTOMATIC TELEPHONES.—The Manchester Telegraph and Telephone Advisory Committee issued a report on December 12th outlining a scheme for the development of Manchester's telephone facilities. It has been decided gradually to convert all the exchanges within a radius of seven miles from Manchester Town Hall to the automatic service. The Central and City exchanges in York Street, Manchester, are at present equipped with apparatus for 10,000 lines each, and it is expected that, with normal development, the spare capacity of those exchanges will be exhausted in about three years. A site has been acquired in Chapel Street, Salford, in order to provide for further growth. Equipment in the new exchange will be ready in 1928, when a proportion of the Central and City lines will be transferred. The existing apparatus at York Street will then be ready for conversion to the automatic system. Sites for automatic exchanges have also been acquired in the Ardwick, Moss Side, and Collyhurst districts of Manchester, and they will be in operation in the next four or five years. It is hoped ultimately to provide automatic exchanges at Prestwich, Droylsden, Bredbury, Stretford, and Swinton. Altogether the scheme, apart from the equipment necessary for the York Street and Chapel Street buildings, provides for a total of 31 automatic exchanges. The number of telephones used in the Manchester district has doubled during the last 12 years. There is a mileage increase in the main lines of 446 per cent., and in subscribers' lines of 152 per cent. Call offices have increased from 427 in 1913 to 525 in September, 1924.

Radio Notes.

Aerials.—BRADFORD.—The Bradford Corporation Committee (Street, Drainage and Works), which recently decided to charge 7s. 6d. for the first year and 2s. 6d. per annum renewal for permits to place radio aerials across streets, has decided to rescind that decision so far as private aerials are concerned. The Town Clerk has been asked to prepare a form of licence in lieu of that now in use, which will be cancelled. The form will not provide for payment of any acknowledgment and counterparts will not be kept, but there will be a register of licences, and a charge of 2s. 6d. made for each licence. No licence will be granted in respect of any wire to be placed over tramway trolley wires or in places where there is sufficient space for placing the aerial on the premises and thereby avoiding its passing over the street. Owners of aerials at present over streets without licences must remove them, unless a licence is obtained "within reasonable time."

YEADON (YORKSHIRE).—The erection of aerials across the public streets is causing concern on the part of the Urban District Council, and the advice of the city engineers of Leeds and Bradford is being sought in the matter of the best method of securing some control.

A New Valve.—IMPROVED DULL EMITTER.—A new valve has been made by Dr. Leonard Levy and Mr. West. By a curious coincidence another engineer, Mr. A. C. Hyde, has made the same discovery, and the three inventors have collaborated and have succeeded in making a dull emitter valve which entirely does away with the necessity of the accumulator, says the *Daily Mail.* In dull emitter valves the tungsten filaments are coated with thorium, but photomicrographs are said to have revealed the fact that the thorium has been present only in the form of minute globules of metal on the tungsten wire. The discovery has been made that if the thorium is deposited upon a molybdenum wire it becomes completely coated with thorium, and the new valve can be overrun without fear.

Dual Transmission.—LONDON'S INNOVATION.—A new departure in broadcasting in this country was made on December 15th, when the opera, "Prince Igor," at the Brussels Opera House, was relayed by the high-power station at Chelmsford, 5 XX, while 2 LO was sending out an ordinary programme. Again, on December 29th, and every Thursday, beginning on New Year's Day, London and Chelmsford will provide separate programmes. Every Tuesday, beginning in January, London and Chelmsford will take different programmes from the London studios at Savoy Hill. Artistes in the two existing studios will be broadcasting from London and those in two new studios to be erected, from Chelmsford. Every Saturday the high-power station will broadcast the programme of one of the provincial stations, beginning on January 3rd, with Bournemouth.—*Daily Mail.*

India.—BROADCASTING.—Our Indian correspondent reports that Commander R. L. Nicholson, director of wireless in India, thinks that though broadcasting might have a considerable vogue in the big centres of population and among planters and others in outlying districts, there are certain difficulties to contend with, not the least being the serious scarcity of first-class entertainment talent. A new company is being started in Rangoon for the purpose of broadcasting, and application for the licence has already been submitted to the Government. It is understood that negotiations in connection with the buying of the apparatus for the purpose are shortly to be opened with Home concerns. The successful experiments in broadcasting made in Rangoon so far justify the starting of the company, in the eyes of the promoters. The Calcutta Radio Club has just received the first issue of the *Indian Radio Review*, which will be published as a monthly journal.

New Station.—SWANSEA.—A new broadcasting station was opened by the B.B. Co. at Swansea on December 12th. It is a relay station, with the call signal 5 SX and a wave-length of 318 metres.

NEW STUDIO.—On the same day a new studio was inaugurated at the Manchester station, 2 ZY.

International Radio Week.—EVENING TRANSMISSIONS.—A statement has been issued by the Hon. Secretaries of the Wireless Retailers' Association with regard to the results achieved in the evening transmissions by various nations in connection with International Radio Week. In the course of the week music and speech were broadcast in turn from Great Britain, America, Belgium, Denmark, and France. With the exception of those from Denmark, the transmissions were re-broadcast by the B.B.C. and were heard throughout the country. Even users of crystal sets were enabled to participate, and reports so far received show that the keenest interest was awakened. The best re-broadcast of KDKA yet accomplished took place between 11 and 11.30 p.m. on Wednesday, November 26th, when, atmospherics notwithstanding, well-known musical pieces and most of the announcements were relayed to all stations in this country.

Radio Records.—JAPAN TO FRANCE.—An amateur wireless enthusiast living in the department of the Basses-Pyrenées, M. Menars, states that he has picked up the JFWA station at Tokio on a 90-metre wave length. This station was heard clearly for ten minutes. It is stated to be the first time that an amateur transmitting station in Japan has been picked up by an amateur receiving station in France.—*Reuter* (Paris).

NOVA SCOTIA-NEW ZEALAND.—It is reported that an amateur wireless station in Nova Scotia has established two-way communication with New Zealand.—*Reuter* (Dartmouth, N.S.).

Relaying.—CABLE PROBLEM.—Recent experience has shown that some of the long-distance land-line relaying has not been so good as the B.B.C. would like. Partial failure of the Irish cable in the relaying of British performances to Belfast has caused the British Broadcasting Co. to try to determine whether submarine cables can be made more efficient for relaying over distances exceeding 40 miles. While the engineers are studying the problem, speech only, and not music, will be relayed to Belfast. Such cables were designed for speech, but with music some of the higher frequencies are attenuated or lost.—*Daily Mail.*

Switzerland.—RELAYING.—London's Christmas broadcasting is to be relayed for winter visitors by Swiss stations. Swiss listeners have increased from a few hundreds a year ago to more than 30,000.

United States.—SIMULTANEOUS BROADCASTING.—In the celebration of Defence Day under the auspices of the Army authorities, 19,000 miles of telephone wire were connected with eighteen broadcasting stations to make possible a broadcasting event. The nation's lines of communication were also tested when the widely separated army corps centres of the country were linked with their headquarters in Washington. Ordinarily, in connecting broadcasting stations together, transmission is merely one way, that is, outward from the point at which the programme is rendered, but in this case each radio station heard the various speakers by way of Washington. When Major-General Morton in San Francisco talked into the transmitter, his words were not carried directly to station KGO in Oakland Bay, but first went to Washington and then came back, making a total journey of 7,000 miles before reaching KGO.—*T. and T. Age.*

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared in our advertisement pages.)*

Open.

Argentina.—BUENOS AYRES.—May 27th. Department of Navigation and Ports. Semi-portal, portal and wall cranes, lifts, capstans and motors.*

Ashford (Kent).—December 24th. Urban District Council. Three 500- to 600-b.h.p. vertical-cylinder heavy-oil engines for the Electricity Department. (December 12th.)

15,000 yards l.p. distributor cable, 12,000 yards e.h.p. feeder and 5,000 yards service cable. (December 12th.)

Australia. — MELBOURNE. — January 13th. Postmaster-General's Department. Telephone indicators and induction coils and registers. January 20th. Condensers. January 21st. Automatic telephone switchboards. (November 28th.)

February 3rd. Generators, switches, and resistances, reactances and telephone parts, switchboard keys and switchboard jacks. April 21st. Automatic telephone switchboards and associated apparatus.

February 2nd. State Electricity Commission of Victoria. 22,000-V transformers and spares. February 10th. Pedestal and hand sets.

SYDNEY.—February 11th. New South Wales Government Railways. Two lighitng storage batteries. February 4th. Two motor-driven air compressors.

January 27th. Sydney Municipal Council. High-pressure oil circuit breakers.

February 4th. Public Works Department. Two motor-driven self-cleaning water screens.*

Barnes.—January 12th. Electricity Department. One 500-kW rotary or motor-converter, with transformer and switchgear. (See this issue.)

British Guiana.—GEORGETOWN.—January 17th. Sewage pumping plant, including electricity generating plant, direct coupled to crude-oil engines, complete with switchgear, overhead transmission line, and 50 vertical-type electric motors and pumps. Specifications from Messrs. Howard Humphreys and Sons, 28, Victoria Street, S.W.

Cardiff.—January 19th. Electricity Department. One water-tube boiler with mechanical stoker, one 320-tube economiser, and one chimney cooling tower complete. (See this issue.)

Croydon.—January 5th. Electricity Department. Four 500-kW converting plants, complete with semi-automatic starting equipment. (December 5th.)

Guildford.—January 9th. Board of Guardians. Electric wiring and fittings for the Infirmary Children's Home, &c., (December 12th.)

India.—December 19th. India Store Department. 9.6 miles 37/029 4-core telegraph cable for river work in India. (December 12th.)

BOMBAY.—February 24th. Bombay, Baroda, and Central India Railway Co. Electrification of Bombay suburban lines: Sub-station and track sectioning switchgear and accessories, rotary converter sets and transformers; or, alternatively, automatic sub-stations, sub-station equipments and track sectioning switchgear. (December 12th.)

London.—ISLINGTON.—January 16th. Electricity Department. Stores and materials for 12 months, including cables, meters, lamps, transformers, &c. (December 5th.)

METROPOLITAN ASYLUMS BOARD.—December 31st. Electric lighting installation at Highwood Hospital for Children, Brentwood. (December 5th.)

CAMBERWELL, S.E.—January 12th. Borough Council. Six or 12 months' supply of electric lamps. Maintenance of electric lighting, heating and power installations, telephones, &c., for 12 months. Forms of tender from Mr. W. Bell, borough surveyor, Town Hall, Camberwell Green.

Macclesfield.—Town Council. Electric light installation at police offices and cells. Particulars from the Town Clerk.

Salford.—December 19th. Board of Guardians. Two "Ideal" boilers, centrifugal pump, electric motor, &c., in connection with the heating of the board room and offices. Mr. E. H. Inchley, clerk to the Guardians, Poor Law Offices, Eccles New Road, Salford.

South Africa.—JOHANNESBURG.—January 3rd. Municipal Council. Transformers.*

January 17th. Traction-testing panel, tramway motors and spares, electric cable.*

Stafford.—December 20th. Town Council. Wiring for electric lighting of 84 houses, Lammascote estate. Specifications and forms of tender from Mr. W. Plant, borough engineer, Borough Hall.

Stoke-on-Trent.—January 14th. Electricity Department. L.p. switchgear. (December 12th.)

Uruguay.—MONTEVIDEO.—State Electricity Works. December 30th. Four air compressors.*

December 29th. Five distribution switchboards, complete, and one power station generator panel equipment.*

February 12th. 104,500 metres of rubber-insulated cords.*

February 13th. Lubricating oils.*

February 17th. 745,000 metres of special cables for outside use under inclement conditions (Hackethal type).*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Argentina.—BUENOS AYRES.—Great Southern Railway Co.
Equipment of the terminal station at Plaza Constitucion, Buenos Ayres, with electro-pneumatic power signalling, including three-position upper quadrant signals, with complete track circuits and control.—Westinghouse Brake & Saxby Signal Co., Ltd.

The work, for which a contract has been secured in face of considerable foreign competition, will constitute the largest power interlocking installation in South America. Several miles of track will have to be covered by the new power-signalling equipment.—*Modern Transport.*

Barnes.—Fire Brigade and Lighting Committee. Recommended:—
500 yd. .2 x .2 x .10 x .01 sq. in. 4-core cable.—Macintosh Cable Co., Ltd.

Carlisle.—Electricity Committee. Accepted:—
H.p. steam valves (£880).—Dewrance & Co.

Canterbury.—Town Council. Accepted:—
1,250-kW Ljungström turbo-alternator (£9,687).—Brush Electrical Engineering Co., Ltd.
5-b.h.p. electric motor for sludge pump (£70).—Tangyes, Ltd.

Chesterfield.—Electricity Committee. Accepted:—
Underground cable (£317).—British Insulated & Helsby Cables, Ltd.
Aerial services at Highfield Lane (£159).—Macintosh Cable Co., Ltd.

Darvel.—Town Council. Accepted:—
Installing electric light at Council houses.—J. C. Daillie.

Dublin.—Commissioners of Public Works. Accepted:—
Periodical contract for electrical works and supplies, Dublin district.—Handley & Robinson, Ltd.

Glasgow.—Tramways Committee. Recommended:—
Track shoes.—North British Steel Foundry Co.
Cab-tire-sheathed cable.—British Insulated & Helsby Cables, Ltd.
V.i.r. cable.—W. T. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.
Rotary converter for Dalhousie sub-station.—Metropolitan-Vickers Electrical Co., Ltd.
Switchgear for Whitevale and Dalmuir sub-stations.—Metropolitan-Vickers Electrical Co., Ltd.
Oil-break switch and isolating switch for Pinkston power station.—British Thomson-Houston Co., Ltd.
Steel tubing for cable ducts.—Stewarts & Lloyds, Ltd.; Scottish Tube Co., Ltd.
Electric vehicles for the subway (£2,364).—British Thomson-Houston Co., Ltd.

The Tramways Committee recommends that the tender of the Cargo Fleet Iron Co., at £29,150, the lowest British offer, be accepted for the supply of steel rails and fish plates.

Electricity Committee. Recommended:—
Ash-sluicing pump at the Dalmarnock power station (£118).—Drysdale and Co., Ltd
Steel piling at the coal store (£7,110).—Sir Wm. Arrol & Co., Ltd.

Corporation. Recommended:—
Electric lifts (£1,085) in connection with the second section of the Stockwell Street improvement scheme.—A. & P. Steven, Ltd.

Lewes.—Education Committee. Accepted:—
Installing electric lighting at the schools at £1 per point.—E. L. Tappin and Son.

London.—GENERAL POST OFFICE.—Post Office Tube Railway.—A contract has been placed for the connecting of the Post Office Tube railway with various London district post offices, by means of electric lifts, with Messrs. Marryat & Scott, Ltd. The lifts are designed to run at two speeds—at a normal speed while travelling from one floor to another in the post office buildings and at a much higher speed while travelling down the lift tube to the railway, which is 80 ft. below the ground. This is believed to be the largest contract for lifts placed since the war.—*Daily Telegraph.*

PADDINGTON.—G.W. Railway Co.

Gasfilled lamps.—Edison Swan Electric Co., Ltd.
12 months' supply of "Osram" gasfilled lamps.—General Electric Co., Ltd.
Electric motors and starters for the locomotive depôt at Tyseley, Birmingham.—Electric Construction Co., Ltd.

ADMIRALTY.—

40 ampere gauges.—Park Royal Engineering Co., Ltd.
Part contract for "Cosmos" gasfilled; vacuum traction, spiralised filament; vacuum standard lamps, and special Admiralty lamps, vacuum type.—Metro-Vick Supplies, Ltd.
107,000 "Osram" squirrel-cage traction-type lamps and 51,000 "Osram" gasfilled lamps.—General Electric Co., Ltd.
Carbon filament lamps.—Edison Swan Electric Co., Ltd.

H.M. OFFICE OF WORKS.—

L.p. switchgear at National Physical Laboratory.—Park Royal Engineering Co., Ltd.

METROPOLITAN ASYLUMS BOARD.—The following tenders were received for alterations to the electric lighting at the Western Hospital:—

Coley & Swinnerton, Ltd.	£466
S. Reed & Sons	515
G. A. Weston	624
Stegman & Co.	752
Toy & Winslow	830
Eastern Armature Co.	950
Central Power Engineering Co.	970
Burdett & Co., Ltd.	990

WAR OFFICE. Accepted:—

Electric lighting installation at Warley Barracks.—W. Saunders, Ltd.

STEPNEY.—Electricity Supply Committee.

D.c. switchgear:—

Ferguson, Pailin, Ltd. (Recommended.)	**£485**
Edison Swan Electric Co., Ltd.	487
Bertram Thomas	542
General Electric Co., Ltd.	565
Crompton & Co., Ltd.	660

2 tons plumber's solder and ¼ ton tinmen's solder (£267).—G. W. Neale, Ltd. (Accepted.)
2 tons sheet lead (£102).—T. & W. Farmiloe, Ltd. (Accepted.)
50 tons pitchwork (£152).—Smith's Tar Distillery, Ltd. (Accepted.)
100 2½-amp. prepayment meters.—Ferranti, Ltd. (Recommended.)

HAMMERSMITH.—Electricity Committee. Recommended:—

500 yd. 0.2 l.p. cable (£252).—Union Cable Co., Ltd.

WOOLWICH.—Ordnance Factories, Royal Arsenal.

Mushroom miners' lamps, with lens fronts.—Metro-Vick Supplies, Ltd.

ST. MARYLEBONE.—Electric Supply Committee. Recommended:—

Armour-clad e.h.p. switchgear in connection with the bulk supply from the Central Electric Supply Co., Ltd:—

	Desk Type Control Panels.	Pillar Type Panels.
British Thomson-Houston Co., Ltd.	6,598	—
General Electric Co., Ltd.	6,538	6,538
Metropolitan-Vickers Electrical Co., Ltd. ...	6,479	—
A. Reyrolle & Co., Ltd.	6,427	6,727
Ferguson, Pailin, Ltd. (Recommended) ...	**6,230**	—

Switch for control equipment at Aybrook Street (£632).—Ferguson, Pailin, Ltd. (recommended).

Padiham.—Lancashire Electric Power Co.

Steelwork for new power station.—Lambourne & Co., Ltd.

Paris.—Gennevilliers central power station.

Valves for the h.p. steam and feed-water pipe ranges for the extensions at the power station.—Dewrance & Co.

Portsmouth.—Board of Guardians. Accepted:—

Electrical stores and electric lamps.—H. A. Evans.

South Africa.—Rand Water Board.

Two electrically-driven pumping units, with spare parts, for the Vereeniging pumping station (£4,309).—Reunert & Lenz, Ltd. (Accepted.)
Steam turbo-centrifugal pump (capacity 10 million gallons per day).—Reunert & Lenz, Ltd., for Belliss & Morcom turbine and pulsometer pump (£9,830); additions for larger condenser spares (£639). Total, £10,469. (Accepted.)

JOHANNESBURG.—Municipal Council. Accepted:—

Underwriters' wire (£2,529).—Telegraph Manufacturing Co. (Col.), Ltd.; (£1,495), United States Rubber Co.
8 h.p. metal cubicles (£808).—Metropolitan-Vickers Electrical Co., Ltd.
Electric cable.—(£37,660), Telegraph Manufacturing Co. (Col.), Ltd.; (£216), Siemens Bros. & Co., Ltd.; (£5,640), W. T. Henley's (S.A.) Telegraph Works Co., Ltd.; (£1,813), Metropolitan-Vickers Electrical Co., Ltd.; (£527), Bartle & Co., Ltd.
Transformers and switchgear (£4,567); 42 current transformers (£135).—Metropolitan-Vickers Electrical Co., Ltd.

South African Power Engineer.

Victoria Falls and Transvaal Power Co., Ltd.

H.p. switchgear and transformers for the new Witbank generating station and Brakpan distributing station (approx. £250,000).—Metropolitan-Vickers Electrical Co., Ltd.

It is stated that this order, which has been obtained in face of severe competition with firms in America and other countries, is the largest order for h.p. switchgear and transformers ever placed in this country, and the operating line voltage of 132,000 V is the highest ever undertaken for power transformers by any British manufacturers.

Sunderland.—Corporation. Subject to the sanction of the Electricity Commissioners and to a satisfactory grant being obtained from the Unemployment Grants Committee, the Corporation has accepted the tender of Messrs. Fraser & Chalmers for a new 10,000-kW turbo-generator.

Siemens-Schuckert meters.—R. Hornby & Co., Ltd.

Notes.

Accidents.—Two workmen at the Crown Street electricity works of the Preston Corporation were injured last week through the bursting of a generator driven by a steam turbine. It is suspected that the accident was caused by an internal fault in the construction of a cast metal ring.

Last week a short circuit occurred on a Huddersfield Corporation electric tramcar, and the conductor, Herbert Hoyle, who was holding the door and a metal handrail, received a shock so severe that he was rendered unconscious and had to be taken to the Royal Infirmary, where he was detained. A passenger on the car received burns on his hands.

Electrical Contractors' Association (Newcastle Branch).—The annual dinner of the Newcastle-on-Tyne branch of the Electrical Contractors' Association and allied electrical trades was held in Newcastle on the 11th inst. Mr. P. W. Wood presided. Mr. A. Andrews toasted the Lord Mayor and Corporation. The Deputy Lord Mayor, in responding, said that Newcastle had been a pioneer in electric lighting matters, and one of their former citizens—Sir Joseph Wilson Swan—was one of the originators of the incandescent lamp. The Sheriff also responded. The "Electrical Contractors' Association" was proposed by Mr. W. T. MacCall, chairman of the North-Eastern Section of the Institution of Electrical Engineers. In responding, Mr. W. Riggs, president of the Electrical Contractors' Association, said that recently he was in West Yorkshire and found that the activities of the Newcastle Electric Supply Co. extended even to that part of the country. He had experienced the comforts of the all-electric house in that district. In the south it was different; there agriculture was the dominant industry, and electricity had not been developed to the extent it had been developed in the north. He claimed that the 900 members of the E.C.A. constituted the cream of the industry. The toast, "Kindred Associations," was proposed by Mr. L. G. Tate, the general secretary of the E.C.A.; Mr. J. Gledson, president of the Electrical Wholesalers' Federation, and Mr. E. L. Beck responded. "The Newcastle Branch of the E.C.A." was proposed by Dr. W. M. Thornton, and Mr. P. W. Wood responded. Other toasts also were honoured.

Electricity in the Home.—The *Gas World* says the following display advertisement appeared in a recent issue of the Ellensburg (Washington) *Evening Record*:—

Why
KILL YOUR WIFE?
Let Electricity Do It!
We'll Help!
Electric Supply and Fixture Co.

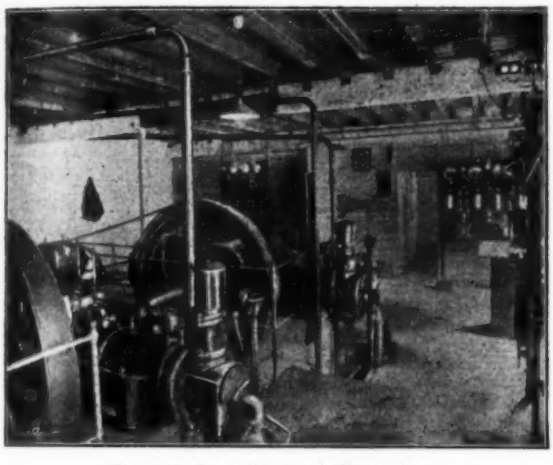
Local Societies.—NEWCASTLE ELECTRICITY SUPPLY.—Mr. R. P. Sloan, C.B.E., chairman and managing director of Newcastle-on-Tyne Electric Supply Co., Ltd., in an address to the Newcastle Rotary Club on the 5th inst., upon the "Development of Newcastle-on-Tyne Electric Supply Company's Undertaking," said the Company served direct, or through its associated companies which it controlled, an area of approximately 1,400 square miles, reaching from Alnwick in the north to Saltburn in the south, the population within that area being over two millions. The h.p. connected to the system in 1920 totalled 472,738, and it was estimated that by the end of the current year the connected h.p. would approximate 600,000; during the past five years the average increase had been at the rate of 33,862 h.p. per annum. Unfortunately, owing to the very great increase in the cost of coal, neither the company nor its consumers had reaped corresponding benefits as a result of the improvements referred to. In 1891 and for many years afterwards the average cost of the coal consumed was 4s. 3d. per ton. To-day for a coal of no better quality the average cost was 18s. per ton; even as recently as 1911 they obtained all the coal they required at an average cost of only 6s. 4d. per ton. Twenty-two cables (including power, pilots, and telephone cables) had been carried from one side of the Tyne to the other through a tunnel specially constructed for the purpose under the bed of the river at a depth of 25 ft. below low water mark; it had its outlets on the Carville power station site on the north, and in Messrs. Palmer's shipbuilding yard at Hebburn on the south. Access was gained by means of vertical shafts more than 100 ft. deep and 6½ ft. in diameter; the length of the tunnel was close upon 1,000 ft. and it had a diameter of 6 ft. It was the only tunnel ever constructed under the Tyne.

EXIDE BATTERIES. — By request of the Private Chauffeurs' Club, Liverpool, Mr. E. C. McKinnon, chief engineer of the Chloride Electrical Storage Co., Ltd., recently gave the members a lecture, in the course of which he gave useful information on the method of ascertaining the state of a battery, also the reasons for some batteries not lasting as long as others. The position of the battery on the car was a contributory source of potential trouble, and the lecturer was very definite in deprecating the employment of "dopes to doctor" a discharged battery. An interesting discussion followed, in which Mr. McKinnon, at the request of the Chairman, explained that "Lightning" consisted essentially of about 95 per cent. of strong sulphuric acid, a little colouring matter, and small percentages of Epsom and Glauber salts.

Electricity on the Farm.—Two years ago the Cheadle and Gatley Urban District Council inaugurated an electricity supply, and already it has proved its value in helping both the residential and industrial development of this Manchester suburb. Messrs. Henry Simon, Ltd., the flour mill machinery firm, have acquired land in the area on which a new model engineering works is now being erected in a district which is "town-planned" for the industrial area. The Oil Well Engineering Co. is also taking a large supply of electricity, and there are now 500 household consumers. The farming community has also welcomed the inauguration of the electricity supply. Farmers are installing it in their houses and in their shippons and outbuildings. Electricity is being used to drive machines such as chaff cutters, and in view of the conditions now enforced by agricultural labourers, the farmers are making good use of the service.

Mr. C. H. Wordingham, C.B.E., is the consulting electrical engineer to the Council, and the supply is obtained in bulk from the Manchester Corporation electricity works.

Electricity in a Small Township.—For the past two years an electricity supply has been available in the urban district of Bromyard (Hereford), which has a population of about 1,500. The supply is afforded by Messrs. A. & E. Pettifer, Ltd., who have a small station containing two 20-b.h.p. Crossley crude-oil engine sets; this is illustrated in the accompanying picture. About 50 dwellings are connected to the



Power Station at Bromyard (Hereford).

system, which includes about four miles of overhead mains. In addition, the company supplies energy for public lighting. The charges are 1s. per kWh for lighting and 6d. for power, and the fact that the firm has found it necessary to arrange for the installation of an 80-h.p. set is an indication of the success of the venture.

Appointments Vacant.—Telegraph foreman (£400) for the Government of Nigeria Post and Telegraph Department. Assistant telegraph engineer (£480) for the Government of the Gold Coast. Meter repairer and tester for the Aberdare Urban District Council Electricity and Tramway Department. Plumber-jointer and wireman for the Radcliffe Urban District Council electricity works. Assistant in the Accountant's Department (£160) for the Bexhill Corporation Electricity Department. Testing assistant for the Barrow-in-Furness Electricity Department. (See our advertisement pages to-day.)

The Batti-Wallahs' Society.—On Wednesday last week the Batti-Wallahs entertained Engineer Vice-Admiral Sir Robert B. Dixon, K.C.B., to luncheon at the Hotel Cecil. Addressing the members afterwards, Sir Robert outlined the four-year course of training in electrical engineering that is provided for engineer officers of the Navy at Keyham, and the additional course for officers specialising in electrical engineering, at the Royal Naval College, Greenwich. Referring to the electrical transmission of power on warships, he said it had been adopted on United States battleships, but not, he believed, on new cruisers. Whilst electrical transmission was quite satisfactory, so was single-reduction mechanical gearing, of which the Navy had had experience of 600 sets without a single failure; the former was slightly less efficient, except at low power, and its greater weight and volume would entail a reduction in fighting efficiency. However, the Admiralty had an open mind on the subject, and the possibilities of electric transmission were always kept in view. The chairman, Mr. Greenly, announced that Mr. C. H. Wordingham, C.B.E., was improving in health, and Mr. H. T. Harrison had benefited by his sea voyage.

Aeroplane Cable Guides.—Official experiments are to be carried out by the Air Ministry at the London air station, Croydon, in an attempt to solve the problem of guiding aeroplanes safely to earth when the alighting ground is obscured by mist or fog, and the pilot is robbed of normal vision. Apparatus is to be installed at Croydon which, under conditions of bad visibility, enables an incoming airman to ascertain not only exactly where he is in relation to the aerodrome below, but also his exact height above its surface. Electric cables are to be laid across the aerodrome in long straight lines, some distance apart, and connected together at each end. These cables radiate upwards a powerful field, which influences delicate apparatus in aeroplanes flying above.

As a pilot nears the aerodrome in mist or fog—having been aided in his flight from some foreign air-station by wireless direction-finding—he will watch an instrument-board before him on which are mounted a series of small electric light bulbs of various colours. These, as the aeroplane comes under the influence of the field of the cable below, will begin to glow, and will indicate to the airman, as he manœuvres over the aerodrome, exactly when he is above the guiding cable and also exactly when he begins to deviate from it. Watching his glow-lamps, and steering accordingly, he will fly round and round the aerodrome, gradually reducing height, being warned, as he does so, by a second row of lamps on his instrument-board, of his precise height from moment to moment above the surface of the ground. In this way he will creep down until he glimpses at quite short range one of the powerful fog-piercing lights on the aerodrome, and is able to land safely.—*Daily Telegraph.*

Annual Exhibition of the Physical Society of London and the Optical Society.—This exhibition, which is to be held on Wednesday and Thursday, January 7th and 8th, 1925, at the Imperial College of Science and Technology, South Kensington, will be open from 3 to 6 p.m. and from 7 to 10 p.m. Mr. F. Twyman, F.R.S., will give a lecture on "Some Experiments with Interferometers" at 4 p.m. on January 7th and at 8 p.m. on January 8th. Mr. C. F. Elwell, B.A., M.I.E.E., will give a lecture on "Talking Motion Pictures at 8 p.m. on January 7th and at 4 p.m. on January 8th. These lectures will include demonstrations. More than 50 firms are exhibiting scientific apparatus, and a number of experimental demonstrations have been arranged.

We understand that invitations have been given to the Institution of Electrical Engineers, the Institution of Mechanical Engineers, the Chemical Society, the Radio Society of Great Britain, the Röntgen Society, and the Faraday Society. Admission in all cases will be by ticket only, and members of the societies above mentioned should apply to the secretary of the society to which they belong. Others interested should apply direct to Prof. A. O. Rankine, hon. secretary of the Physical Society, Imperial College of Science and Technology, South Kensington, S.W.7.

Radio Direction-Finding.—With the object of taking regular observations of the apparent radio bearings of various transmitting stations, it was decided towards the end of 1920 to erect a number of directional receiving sets in various parts of the British Isles. They were placed by the Directional Wireless Committee of the Radio Research Board under the supervision of Dr. R. L. Smith-Rose, whose first report on the results was issued on December 2nd. Ten observing stations were set up in 1921, seven being located at British Universities, and the work was continued until this year. During the first year observations were confined to fixed stations operating on wavelengths between 2,000 and 9,000 metres. Some 41,000 readings are summarised. Later investigation was extended to much shorter wavelengths. Two points are emphasised: The first is that the stations on whose transmissions observations were made were situated at considerable distances from the receivers—rarely less than 100 miles, and in some cases more than 1,500; and the second is that in most cases the transmitted waves passed over considerable tracts of land. In the extension of the work to the shorter waves it has been possible to locate one of the observing stations on the coast, and to take readings of the apparent bearings of various ships' transmitting stations whose positions were known at the time. By this arrangement the transmitted waves passed entirely over sea, and it has already been found that under such conditions at distances up to the order of 60-100 miles the radio direction-finding observations show a variation of only a few degrees, the individual bearings showing a maximum error of the order of 5 deg.

Simultaneous observations taken on the same waves after they had travelled considerable distances over land showed variations of the order of 60 deg., thus being comparable with those tabulated in the report. This aspect of the results is of considerable importance in the application of radio direction-finding to marine navigation problems, where most of the work is carried out at comparatively short distances (less than 100 miles), and where the transmission is nearly always entirely over sea.

An Electric Road Roller.—One of its steam road-rollers having broken down, the Milwaukee Electric Railway & Light Co., of Milwaukee, U.S.A., has recently converted it into an electric trolley machine. The steam boiler portion has been replaced by an electric motor which drives the roller through the same gearing as was employed in connection with the steam engine. The converted machine is now being used on all roads where it is able to draw a supply of electricity from overhead mains.

The "Princeps" Clock.—In our report of Major Prince's lecture on the above subject, in our issue of December 5th (p. 877), we erroneously stated that the difference between the decrements of the free pendulum and the "Princeps" pendulum was one-half of one per cent., in favour of the former. This difference, however, is only .001 per cent.

Power Alcohol From Beet.—The British Power Alcohol Association (affiliated to the British Empire Producers' Organisation) has presented a case to the Government by means of a deputation to the Minister of Agriculture, asking for the proposed subsidy of 19s. 6d. per cwt. on sugar produced from beet to be extended to the sugar content of beets used for making power alcohol. The chief points made by the deputation were the agricultural importance of the beet crop and the very serious need of an alternative motor fuel to petrol.

Oil-Engined Electricity Generating Stations.—The generation of electricity in large steam-driven stations necessitates the location of the stations near large sources of water, which in most cases involves the provision of h.p. transmission lines and sub-stations, thus adding to the cost of the scheme. In a paper he recently read at the Birmingham Electric Club, Mr. C. W. Chapman, B.Eng., of Ipswich, submitted that by means of small internal-combustion engine stations in the centre of the consuming area, of a capacity to deal comfortably with this area only, power could be generated at a cost as low as, or perhaps even lower than, "super" steam stations. Moreover, he contended that an economical supply of power would thus be available immediately, so encouraging industry at present held up pending the mooted bulk supply. Temporary failure of such plant would affect only a small area, whereas in the case of failure of bulk supply the consequences were little short of disastrous. He considered generating stations of about 1,000 kW total installed capacity, such as might supply institutions, factories, small towns, &c., or act as stand-by or reserve units, and he pointed out that for the relatively low powers considered gas and steam plant cannot compete with the modern oil engine: they require bulky auxiliaries, are not instantly available, nor exempt from stand-by charges. Diesel engines are more costly to build and maintain than those in which the oil is injected into the combustion chamber directly by means of the pressure supplied by the fuel pump and except in very big sizes (from about 150 b.h.p. per cylinder upwards) they offer no advantage over the solid injection engine, which is now thoroughly established, and for moderate powers is almost universally preferred to the full Diesel, eliminating as it does the biggest potential source of trouble and danger—the high-pressure air system. The author discussed the running cost and fuel consumption of 4- and 2-cycle engines, and formed the conclusion that for the powers of engines under consideration there is little to choose between the three types of solid injection engine discussed on the score of reliability. On the score of running cost, there is again little to choose for normal conditions. Regarding first cost and general capital charges, the two-cycle engine gains over the four-cycle. When constructed vertically, all these types have approximately the same speeds of rotation. Concerning cyclic variation, the two-cycle engine gains, for with a given weight of flywheel it can attain a cyclic variation better than a four-cycle engine having twice as many cylinders, thereby reducing the number of moving parts, with consequent greater reliability. On the score of close governing, there is no difference between the four- and the two-cycle. For low powers the two-cycle engine with a completely cooled combustion chamber will become the favourite owing to its absolute simplicity, but for larger powers, complete scavenging will be absolutely essential in order to carry the necessary high brake mean pressures, and an engine will probably soon be on the market working on the two-stroke cycle adapted to give the complete uniflow scavenge at present obtained in the opposed-piston two-cycle engines, but without the excessive height and complications of this type.

"As Others See Us."—A recent article in the United States *Commerce Reports* discusses electrical development in Great Britain, and pays particular attention to the factors which have militated against it. It says, *inter alia*, that in many cities existing gas systems are owned by the municipality, and such municipalities have not been able, or have not had the incentive, to add a competing electrical service, nor have they been willing to permit private enterprise to develop electrical service which would compete with city-owned gas systems. Even where gas systems have not been owned by municipalities, but have been in the hands of private operators, strong opposition to any electrical development has been apparent. The vested gas interests in England were well entrenched long before electricity came into the field, and they have successfully maintained opposition to the introduction of electricity in many sections where otherwise it would have become available. A factor not much discussed, which has undoubtedly some bearing on the whole situation, is possibly the high prevailing taxes. No doubt many municipalities, which may desire either to install electric lighting systems or to expand existing systems, are faced with opposition due to the prevailing heavy tax charges and the hesitancy on the part of property owners to do anything that might result in an increase in that item of their domestic budget. There are, however, other factors which have been fundamental deterrents to a broad use of electricity throughout the country, in addition to those cited. For instance, overhead lines have not been popular in England and electrical systems have, therefore, been handicapped by inability to extend cheaply into areas where scattered consumers were to be served. No doubt from an æsthetic viewpoint an overhead line is oftentimes not desirable, but unquestionably there are many portions of the cities and urban districts in which a well-built overhead line will not materially detract from the beauty of the surroundings, while, on the other hand, it would permit of electrical service being rendered at a reasonable cost to consumers.

Pure Mineral Lubricating Oils.—The British Engineering Standards Association has published Specification No. 210-1924, a classification of pure mineral oils. This classification is intended to be a broad guide to users of pure mineral lubricating oils to enable them to describe their wants in a more precise manner than is now frequently done. Typical specifications for each type and grade of oil are given, but it is not intended that the specifications should be used as purchasing specifications. The classification has been made under four main heads, as follows:—(*a*) Machinery and engine oils (pale or red); (*b*) internal-combustion engine oils (pale or red); (*c*) steam cylinder oils (dark); (*d*) steam cylinder oils (red). Oils containing fatty oils have not been included. Extensive notes are given indicating the purposes for which each grade and type of oil is best suited, and full details are given for the testing of the oils, the methods of testing described being those recommended by the Institution of Petroleum Technologists. Copies of the publication may be obtained from the B.E.S.A. Publications Department, 28, Victoria Street, S.W.1, price 1s. 2d., post free.

A Portable X-ray Outfit.—The plumber, electrician, jeweller and builder can now use X-rays to aid them in their work. Dr. W. D. Coolidge, inventor of the Coolidge X-ray tube, has devised in the research laboratories of the General Electric Co. a new portable X-ray machine that weighs only 30 pounds, and that can be plugged into an ordinary electric light socket. Dr. Coolidge made the first practical use of his new invention when he used it to locate pipes in his bathroom floor. Crystals produce characteristic diffraction patterns when a small beam of X-rays is shot through the stone and observed in a fluoroscope, allowing the new apparatus to be used for testing the genuineness of diamonds and other precious stones.—*Science Service.*

The Structure of the Atom.—At the Imperial College of Science and Technology, London, on Monday evening, Dr. T. F. Wall, of Sheffield University, gave a lecture on his experiments with very intense magnetic fields, by means of which he hopes to disturb the orbits of the electrons in atoms of matter, with a view to releasing some or all of the energy locked up in the atomic structure. Our report of the lecture will appear in our next issue.

Institution Notes.

Institution of Electrical Engineers.—INFORMAL MEETINGS.—At the meeting of the Informal Section on December 8th, Mr. J. Coxon in the chair, Mr. G. M. Clark, M.A., delivered a lecture entitled "A Walk Round Pretoria Power Station." He showed a large number of lantern slides of the station during all stages of erection. The works is a good example of the way in which difficulties of transport and labour can be overcome in remote situations; the new station is some four miles outside the town, and the old station has been turned into a converter station. A very low-grade coal costing 1s. 6d. per ton at the pit-head is carted 80 miles at a cost of 6s. 9d. per short ton for freight. This was the most notable factor in the figures.

Royal Institution. — The before-Easter lecture arrangements at the Royal Institution have just been issued. The general courses will begin on Tuesday afternoon, January 13th, at 5.15, when Professor A. Fowler will commence a course of two lectures on "The Analysis of Spectra"; on later Tuesdays there will be two lectures by Prof. E. N. da C. Andrade on "The Evolution of the Scientific Instrument." The Thursday afternoon lectures include four by Sir William Bragg on "The Properties and Structure of Quartz," and two by Mr. T. Thorne Baker on "Chemical and Physical Effects of Light." The Saturday lectures will include four by Sir Ernest Rutherford on "The Counting of the Atoms." The Friday evening meetings begin on January 16th with a discourse by Sir William Bragg on "The Investigation of the Properties of Thin Films by Means of X-Rays." Succeeding discourses will probably be given by Professor J. W. Gregory, Sir Ernest Rutherford, and others.

Junior Institution of Engineers.—On December 5th, Mr. J. B. Polland gave a demonstration of metal-cutting under water by the oxy-acetylene blowpipe. Mr. Polland stated that an oxidising and not merely a heating flame was used for cutting purposes. The centre of the jet of the blow-pipe, therefore, consisted of the actual cutting flame, while the envelope round that was more heating and yet of such a nature that its heat was dissipated more quickly in water. Round the whole of this jet was a further envelope of air which acted as an insulating medium between the flame and the water.

Institution of Civil Engineers.—HEAT ENGINE TRIALS.—An extra meeting of the Institution of Civil Engineers was held on Thursday last week, in conjunction with the leading engineering and chemical societies, which are co-operating in the work of the special committee on tabulating the results of heat-engine and boiler trials. The Chairman of the Committee, Capt. H. Riall Sankey, C.B., C.B.E., introduced for discussion "Standards of Comparison in Connection with the

Thermal Efficiency of Steam Engines." Pointing out that since 1896, when a committee of the Institution was appointed to define a standard, practice had changed materially in respect of the heating of feed-water by live steam abstracted from the engine, and the re-heating of steam after partial expansion, the author put the question: Can a standard of comparison be defined which will meet all cases?—and proposed a modification of the definition of the Rankine Cycle which, he submitted, met the case. Capt. Sankey proceeded to discuss the principal cases that arose in practice, and gave examples, fully worked out, of two typical cycles. A number of worked-out cases were also given in the form of tables, using various steam tables, from which it appeared that the disparities between the thermal efficiencies obtained were small, and that the thermal efficiency of the standard steam engine of comparison could thus be determined with sufficient accuracy for practical purposes.

Society of Engineers.—At the annual general meeting on December 8th, the following awards were announced:—President's gold medal to Mr. James Jackson for his paper on "Developments of Methods for the Collection and Disposal of House (Domestic) Refuse"; Bessemer Premium (value £5 5s.) to Mr. H. A. Rickwood, A.M.I.E.E., for his paper on "Recent Developments in Ferro-Concrete Cooling Towers"; and the Nursery Premium (value £3 3s.) to Capt. W. J. Liberty, A.M.I.Inst.C.E., for his paper on "Underground London." The Council and officers for 1925 are as follows:—President, Mr. A. Stewart Buckle; Vice-Presidents, Messrs. G. O. Case, D. C. Fidler and E. F. Spurrell; Members of Council, Messrs. W. J. Hadfield, F. Purton, H. C. Adams, A. K. Dodds, F. H. Hummel, C. H. J. Clayton, H. C. Hawkins, W. M. Beckett, F. W. Mackenzie-Skues, J. F. J. Reynolds, and W. Holttum; Hon. Secretary and Treasurer, Mr. T. J. Gueritte; Members of Council *ex-officio*, Mr. G. A. Becks and Lord Headley.

Our Personal Column.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

The Taunton Town Council last week approved of the Electricity Committee's recommendation that the salary of Mr. A. J. HOWARD, the borough electrical engineer, should be increased from £630 to £695 in compliance with a request from the Association of Municipal Electrical Engineers, who pointed out that the Taunton salary was considerably lower than the minimum agreed upon by the Association and the I.M.E.A. for an undertaking of its size.

The marriage took place at Clitheroe, on December 10th, of Miss MARY E. ORMEROD and Mr. JOSEPH H. SHEPHERD, a member of the staff of the Rawtenstall Corporation Electricity Department. The presents included a timepiece and bronze figures from the bridegroom's colleagues.

Capt. M. VANE MORLAND has been appointed to the position of general manager of the St. Helens Corporation tramways at a salary of £550 per annum, rising to £600. Capt. Morland is at present manager and engineer to the Nottinghamshire and Derbyshire Tramways Committee. He has had 20 years' experience in light railway and tramway operation under Messrs. Balfour, Beattie & Co., Ltd.

Mr. W. HIGHLAND has resigned his position as electrical engineer to the local authorities of Murrumburrah, N.S.W., and has joined the sales staff of the Australian General Electric Co., Ltd., Sydney.

East Grinstead Urban Council has increased the salary of Mr. A. S. HOOPPELL, the electrical engineer, from £312 to £360 per annum, rising by £20 a year to a maximum of £400.

Mr. George Ellison has appointed LT.-COLONEL F. W. FOSTER, M.C., late of the English Electric Co., Ltd., manager of his branch office at Manchester.

Deputy-Mayor Alderman J. O. ROBERTS, J.P., has been elected chairman and Councillor C. A. F. RIDSDALE deputy-chairman of the Gloucester Corporation Electricity and Light Railways Committee for the ensuing year.

The Newport Corporation Electricity Committee has recommended that the salary of the borough electrical engineer be increased from £900 to £1,000 per annum.

Mr. W. HEPWORTH COLLINS asks us to state that he has relinquished his connection with the Corona Lamp Works, Ltd. (in liquidation), Ascham Street, N.W. He was formerly the commercial manager of the Edison & Swan United Electric Light Co., Ltd.

Mr. C. S. SHAPLEY, of Leeds, will be president of the Institution of Public Lighting Engineers for 1925-1926, and the Leeds City Council will welcome the Institution on the occasion of its next annual meeting.

Mr. H. C. IVERSON has severed his connection with Messrs. Medway's Safety Lift Co., Ltd., having been appointed sales manager to Messrs. R. A. Evans, Ltd., lift engineers, of Leicester. His office is at Avenue Chambers, Southampton Row, London, W.C.2. (Telephone No.: Museum 3240.)

MR. WM. KIRKHAM, A.M.I.E.E., late of G. D. Peters & Co., Ltd., and Walker Vehicles, Ltd., and for many years manager of Siemens Brothers & Co., Ltd., and Siemens & English Electric Lamp Co., Ltd., Manchester branch, has taken up an appointment in the Traction Department of the General Electric Co., Ltd. His address is Magnet House, Victoria Bridge, Manchester.

Dr. W. R. COODE ADAMS, M.A., M.Sc., Ph.D. (Camb.), B.Sc. (London), A.I.C., has been appointed an assistant lecturer and demonstrator to Faraday House Electrical Engineering College.

Obituary.—MR. W. LANGDON-DAVIES.—We regret to record the death, which occurred on December 6th, after a long and painful illness, of Mr. Walter Langdon-Davies, M.I.E.E. Mr. Langdon-Davies, who was 58 years of age, had undergone an operation at the Middlesex Hospital, and had been laid up for some months. He was the inventor of the Langdon-Davies single-phase motor, which was a forerunner of most such machines that are now on the market. Some years ago, in indifferent health, he went out to Vancouver, and while there held an important position with the British Columbia Electric Railway Co., Ltd. He returned to this country in the early years of the war and joined Mr. Alfred Soames in electric welding work. Mr. Langdon-Davies subsequently invented the Daysohms electric arc welder. Owing to Mr. Davies's death and other causes, Mr. Soames is now selling the Daysohms business to Alloy Welding Processes, Ltd. The deceased gentleman was the son of Charles Langdon-Davies, the inventor of the Phonopore. He was born at Hong-kong.

MR. C. LACROZE.—A financial newspaper states that Mr. Carlos Lacroze, a director of the Buenos Aires Lacroze Tramways Co., died at Monte Carlo on December 14th, at the age of 63. He was taken ill in Switzerland some time ago.

Will.—The late Mr. WILLIAM PARR, a director of the Dawlish Electric Light Co., left £27,721 gross and £22,336 net personalty.

New Companies Registered.

Betax Manufacturing Co., Ltd. (202,266).—Private company. Registered December 8th. Capital, £5,000 in £1 shares. To adopt an agreement with Ben Tax for the acquisition of the business carried on by him under the style of Rogers Electric Sales Co. (Great Britain) at 180, Gray's Inn Road, W.C., as a manufacturer and wholesale and retail dealer in electrical goods, and importer and exporter of all classes of goods and merchandise, whether electrical or otherwise. The first directors are:—Ben Tax, 21, St. Vincent's Road, Westcliff-on-Sea, merchant (managing director); Mrs. Bess Tax, 21, St. Vincent's Road, Westcliff-on-Sea (both permanent). Qualification, £100. Remuneration, of first directors, £250 per annum, free of income tax, to be increased annually at the rate of £50 per annum until an annual sum of £500 is payable to each, and 25 per cent. each of the excess profits when a dividend of 10 per cent. is distributed amongst the shareholders. Solicitors: Heald & Thomas, 123, Wardour Street, W.1. Registered office: 46, Oxford Street, W.1.

Serenada Manufacturing Co., Ltd. (202,288).—Private company. Registered December 8th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of, and dealers in loud speakers, horns, bells, electrical apparatus, and all other accessories for wireless apparatus, manufacturers of and dealers in motor and engineering accessories, &c. The first directors are:—S. H. Abrahams, 61, Gunton Road, Clapton, N.; Mrs. B. H. Abrahams, 61, Gunton Road, Clapton, N. Qualification, 50 shares. Solicitors: S. Myers & Son, 25, Wormwood Street, E.C.2. Registered office: 22, Paper Street, E.C.

Cecil Hodges & Co. (Overseas), Ltd. (202,268).—Private company. Registered December 8th. Capital, £1,000 in £1 shares. To carry on the business of electricians, electrical and mechanical engineers, machinists, fitters, founders, millwrights, wire drawers, tube makers, metal workers and founders, suppliers of electricity for light, heat, motive power or otherwise, &c. The subscribers are:—H. C. Hodges, "Elmhurst," Carshalton, Surrey, electrical engineer; H. H. Hodges, "Ripley," Clarence Road, Hersham, Surrey, electrical engineer. The first directors are to be appointed by the subscribers. Qualification (except first directors), 10 shares. Solicitors: W. T. Hick & Co., Broad Street House, New Broad Street, E.C.

Allerton Electrical Supplies, Ltd. (202,264).—Private company. Registered December 8th. Capital, £2,000 in £1 shares. To carry on the business of electricians, mechanical and motor engineers, manufacturers and suppliers of electrical apparatus, wireless sets, &c. The subscribers (each with one share) are:—L. Oulton, 19, South John Street, Liverpool, chartered electrical engineer; R. S. Oulton, 19, South John Street, Liverpool, gent. The first directors are not named. Secretary (*pro. tem.*): L. Oulton. Solicitors: Evans, Lockett & Co., 21, Water Street, Liverpool. Registered office: 12, Adelphi Bank Chambers, 19, South John Street, Liverpool.

Edward Wilcox & Co., Ltd. (202,311).—Private company. Registered December 10th. Capital, £2,000 in £1 shares. To carry on the business of manufacturing electrical engineers, contractors, factors in connection with all branches allied to the electrical industry, including wireless, shippers, &c. The first directors are:—J. Allan, 150, Stretford Road, Urmston, near Manchester, gentleman; E. Wilcox, Beech Cottage, Hayes Lane, Timperley, near Manchester, electrical engineer; L. B. Allan, 150, Stretford Road, Urmston, near Manchester.

Domestic and General Electrical Co., Ltd. (202,247).—Private company. Registered December 6th. Capital, £1,000 in 100 7 per cent. preference and 100 ordinary shares of £5 each. To carry on the business of electrical contractors, general electrical engineers and dealers in electrical goods, &c. The first directors are:—H. P. S. A. Purdie (permanent), 18, Bowes Road, Palmers Green, N.; W. H. Smitherman, 178, Trevelyan Road, S.W.17. Qualification, three fully-paid shares. Solicitors: Judge and Priestley, 3, Liverpool Street, E.C.2. Registered office: 84, Kingsway, W.C.2.

Bosch, Ltd. (13,418).—Private company. Registered in Edinburgh December 8th. Capital, £1,000 in £1 shares. To carry on the business of mechanical and electrical engineers, carriers of passengers and goods, &c. The subscribers (each with one share) are:—D. H. Sayers, 34, Dowanhill Street, Glasgow, solicitor; C. D. Munro, 113, Arisaig Drive, Mosspark, Glasgow, typist. The first directors are not named. Qualification, one share. Secretaries: Rosslyn Mitchell and Tullis Cochran. Registered office: 134, St. Vincent Street, Glasgow.

Waltham Radio, Ltd. (202,324).—Private company. Registered December 10th. Capital, £500 in £1 shares. To carry on business as indicated by the title, and to adopt agreements with H. H. Tarver and H. W. Franklin. The directors are:—H. H. Tarver (chairman), "Trentleigh," Branston, near Burton-on-Trent; H. W. Franklin (managing director), 41, Tottenhall Road, Palmer's Green, N. Qualification, 100 shares. Secretary: H. H. Tarver. Solicitors: Fowler, Legg & Young, 13, Bedford Row, W.C. Registered office: Marathon Works, Markhouse Passage, Walthamstow.

Power Wireless, Ltd. (202,317).—Private company. Registered December 10th. Capital, £2,000 in £1 shares (1,000 10 per cent. cumulative preference and 1,000 ordinary). To carry on the business of electricians, electrical engineers, manufacturers of and dealers in apparatus used in connection with wireless or radio telegraphy, &c. The life directors are:—F. A. Bontor, Woodside, Quarry Wood, Bisham, Berks., oriental carpet manufacturer; E. W. Bontor, 10, Kitson Road, Barnes, S.W., oriental carpet manufacturer; E. J. Power, 24, Brandville Gardens, Barkingside, Essex, electrician. E. J. Power is to be appointed manager. Qualification, 10 shares. Solicitors: Hurford and Taylor, 10, Bedford Row, W.C.1. Registered office: Wexham Road, Slough.

Official Returns of Electrical Companies.

Presteign Electric Co., Ltd. (170,355).—Return dated April 17th (filed June 10th, 1924). Capital, £5,000 in £1 shares. 630 shares taken up. £630 paid. Mortgages and charges at date of return, nil. Since registered: Debenture for unspecified amount.

Primitiva Gas Co. of Buenos Aires, Ltd. (69,267).—Return dated November 11th, 1924. Capital, £2,339,644 in £1 shares. 2,289,909 shares taken up. £220,117 paid. £2,069,792 considered as paid. Mortgages and charges, £1,447,858.

Whitchurch and Pangbourne Electric Supply Co., Ltd. (75,400).—Return dated May 29th, 1924. Capital, £10,000 in 1,700 ordinary and 300 preference shares of £5 each. 1,006 ordinary shares taken up. £5,030 paid. Mortgages and charges, nil.

Richard Garrett & Sons, Ltd.—Particulars filed of £20,000 debentures authorised November 20th, 1924, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Bower Electric, Ltd.—Particulars filed of £10,000 debentures authorised November 10th, 1924, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £2,800.

Oxford Electric Light and Power Co., Ltd. — Issue on November 5th, 1924, of £300 debentures, part of a series already registered.

Anglo-Austrian Electric Lamp Works, Ltd.—Particulars filed of £2,000 debentures authorised November 21st, 1924, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,000.

G.W.I. Valves, Ltd.—Particulars filed of £2,000 debentures authorised November 24th, 1924, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £1,000.

Norwood Wholesale Fittings Supply Co., Ltd. — Particulars filed of £250 debentures authorised December 2nd, 1924, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

A. J. P. Coleman, of 174, High Street, Acton, W.3, was appointed receiver on December 5th, under powers contained in debentures dated December 2nd, 1924.

H. E. Davis, Ltd.—Debenture dated December 2nd, 1924, to secure £2,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: H. E. Davis, 4, South Street, E.C.2.

Simmonds & Stokes, Ltd.—Satisfaction to the extent of £1,000 on October 4th, of debentures dated April 15th, 1924, securing £7,000.

Brown & Whitehead, Ltd. — W. H. Bell, of 3, Bridge Road, Woolston, Hants., ceased to act as receiver on September 6th, 1924. (Notice filed December 4th.)

Portable Electric Motors (1919), Ltd. (in compulsory liquidation).—R. B. Petre, of 11, Ironmonger Lane, E.C.2, ceased to act as receiver or manager on December 1st, 1924.

New Lowca Engineering Co., Ltd.—H. Mossop, of Ramsden Square, Barrow-in-Furness, C.A., was appointed receiver on December 3rd, 1924, under powers contained in second mortgage debentures dated April 3rd, 1908.

Lighting, Heating and Power Installations, Co., Ltd.—F. S. Burman, of 29, Princess Street, Manchester, ceased to act as receiver or manager on July 31st, 1924. (Notice filed December 5th.)

British Battery Co., Ltd. (137,905). — Return dated August 9th, 1923 (filed September 12th, 1924). Capital, £1,000 in 800 preference and 200 ordinary shares of £1 each. 800 preference and 199 ordinary shares taken up. £999 paid. Mortgages and charges, £700.

Dixon & Corbitt and R. S. Newall & Co., Ltd. (24,228C).—Return dated September 12th, 1924. Capital, £160,000 in £1 shares. All shares taken up. £96,150 paid. £63,850 considered as paid. Mortgages and charges, nil.

W. Sisson & Co., Ltd. (82,295).—Return dated August 5th, 1924. Capital, £50,000 in 5,000 preference, 38,000 ordinary and 7,000 deferred shares of £1 each. 4,375 preference, 31,711 ordinary and 7,000 deferred shares taken up. £28,686 paid on 4,375 preference and 24,311 ordinary shares. £14,400 considered as paid on the remainder. Mortgages and charges, £3,020 3s. 7d. (due to Lloyd's Bank, Ltd.).

Cawnpore Electric Supply Corporation, Ltd. (84,233).—Return dated June 11th, 1924. Capital, £547,986 in 160,000 preference and 387,986 ordinary shares of £1 each. 160,000 preference and 160,000 ordinary shares taken up. £245,000 paid. £75,000 considered as paid. Mortgages and charges, £262,820.

British Arc Welding Co., Ltd. (108,759).—Return dated August 20th, 1924. Capital, £50,000 in £10 shares. 1,474 shares taken up. £12,740 paid. £2,000 considered as paid. Mortgages and charges, nil.

Allen West & Co., Ltd. (108,870). — Return dated July 1st, 1924. Capital, £150,000 in £1 shares. 141,724 shares taken up. £141,724 paid. Mortgages and charges, £100,000.

Wireless Experts, Ltd.—Debenture dated November 17th, 1922, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: E. D. Challinor, Durrington Park Road, Wimbledon, S.W.19.

Altrincham Electric Supply, Ltd.—Satisfaction in full on September 23rd, 1924, of debentures issued on various dates from January 10th, 1899, to April 30th, 1917, securing in all £45,000. Debenture dated November 14th, 1924, to secure £80,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd., 15, Bishopsgate, E.C.2.

Satisfaction in full on November 21st, 1924, of two debentures, one dated May 13th, 1921, securing £32,000, and the other dated January 30th, 1924, securing £18,000.

Pickvance, Ltd.—Particulars filed of £1,200 (second series) debentures authorised November 19th, 1924, charged on the company's undertaking and property, present and future, including uncalled capital (subject to first series), the amount of the present issue being £950.

City Notes.

Johnson and Phillips, Ltd.

A meeting of the debenture holders was held on December 9th to consider a proposal to reduce the rate of interest from 8 to 5½ per cent. in lieu of repayment under the terms of the trust deed. As there was an insufficient number of debenture holders to form a quorum, the chairman, Mr. L. Wates, announced that the meeting would be adjourned for a fortnight. He invited those present, however, to discuss the question in an informal manner. Several of the meeting asked for a further adjournment in view of the proximity of Christmas, but the chairman said that the terms of the trust deed would not permit of that.

A stockholder said that the directors' claim that they could raise new money at 5 per cent. was extravagant in view of the yield of War Loan—£4 18s. 6d. per cent. Another holder considered that the debentures should be repaid with the option of taking up new debentures. A committee of debenture-holders was formed to confer with the board in the interval before the resumption of the meeting, and it was subsequently successful in inducing the directors to adopt a modified scheme.

Anglo-Argentine Tramways Co., Ltd.

The company has issued a statement concerning the recent action of the Buenos Aires Municipality which declared that the company's concession for the construction of further subways in that city had lapsed, and, moreover, refused further increases in tariffs. The company states that these decisions were vetoed by the Intendente (Mayor) of the city. The terms of the veto indicate that only in the public interest could the subway concession be cancelled and then the company would have to be compensated. The suggestion of the Municipality that it should contribute to the company's pension fund is declared to be contrary to law. Thus matters appear to be left as they were, and the company is to take up afresh the question of an agreement with the Municipality in April next when the new Council meets.

The directors have decided to pay dividends of 2s. 9d. per share, less tax, on the 5½ per cent. cumulative first preference shares, and of 3s. per share, less tax, on the 6 per cent. cumulative second preference shares for the half-year ending December 31st.

Venezuela Telephone and Electrical Appliances Co., Ltd.

The annual meeting of this company was held on December 11th. Mr. J. S. Austen (chairman), who presided, in presenting the report and accounts (*vide* ELECTRICAL REVIEW, December 5th, p. 869), said that the report was unparalleled in the history of the company. It was even better than it appeared, for taxation, which had always been severe upon the company, had absorbed a sum equivalent to 5 per cent. on the ordinary shares. Even when no dividends were being paid the company had had to pay excess profits duty and corporation tax. He welcomed the abolition of these unjust taxes, but he had heard that the new Chancellor of the Exchequer intended "to have another knock" at ordinary shareholders. The company did not have a monopoly, but it was not afraid of competition; the cost of duplicating its service would be enormous, and precluded all thought of a competing system. The coinage of Venezuela had always been on a gold basis, and three months ago the remittance rate was 23 bolivars to the pound sterling, as compared with a par value of 25.25. The report and accounts were adopted, and by resolution the directors' borrowing powers, up to a maximum of £100,000, were confirmed.

British Columbia Electric Railway Co., Ltd.

The net revenue for the year ended June 30th last, after making provision for depreciation, sinking fund, renewals, corporation profits tax, &c., was £424,261. To this is added £43,337 brought forward, making £467,598. The deduction of debenture interest and interim dividends (£346,232) leaves a balance of £121,366 available. It is proposed to pay a final dividend at the rate of 18s. 8d. per cent. on the preferred ordinary stock, free of tax, making £4 16s. 2d. per cent., tax free, for the year; to pay a dividend at the rate of £2 12s. 6d. per cent., free of tax, on the deferred ordinary stock, making £6 9s. 8d. per cent., free of tax, for the year; and to carry forward the balance of £60,470. The number of passengers carried rose from 67,692,851 to 68,252,634; the amount of freight hauled decreased from 377,822 to 351,308 tons; the total amount of electricity sold increased from 192,453,979 to 216,146,016 kWh; the number of consumers from 76,951 to 80,793; and the motors connected from 90,095 to 96,815 h.p. The charges for domestic lighting were reduced voluntarily during the year, bringing the rate to a very low level. There was a further rise in the amount paid on account of Dominion, Provincial and municipal taxation—the total being $584,159.

During the year $3,116,715 was expended in carrying out further developments at Stave Lake, and in general extension of the business. An issue of £770,000 5 per cent., income tax free, debenture stock was made to provide the necessary capital. At Stave Lake the raising of the dam has been completed, and preparations were actively carried on during

the year for the installation of a fifth set with an output of 18,000 kW. The development work in connection with Alouette Lake is also being pushed forward vigorously. The increase of £848,573 in the property account, and the reduction of investments in subsidiary companies is mainly due to certain exchanges of property as between the company and the Vancouver Power Co., whereby the B.C. Railway Co. has transferred to the Vancouver Co. the shares in the Western Power Co. of Canada, Ltd., and has received various railway, light and power enterprises heretofore owned by the Vancouver Power Co. These transfers have been made to facilitate future administration. There has been a steady growth in the company's business, and the outlook for the coming year is favourable.

The meeting was to be held in London yesterday (Thursday).

German Electrical Companies.

The Telephone Works Company (late Berliner), of Hanover, which has converted the paper mark capital to a gold mark basis, reports that the undertaking is abundantly supplied with profitable orders at the present time.

The *South German Telephone Apparatus, Cable and Wire Works Co.*, which belongs to the group of the Felten and Guilleaume Co., has converted its paper capital of 20,000,000 marks to 3,000,000 gold marks.

The *Land and Sea Cable Works Co.*, of Cologne-Nippes, which is associated with the Felten and Guilleaume Co., and had a share capital of 6,000,000 marks in 1913, has now transformed the paper mark capital to 2,560,000 gold marks.

The *Electricity Company* (late W. Lahmeyer), reports that a slow improvement is taking place in the consumption of current in the case of the electricity works in which the company is interested, as well as in the number of passengers carried on the tramways. The paper mark capital has been reduced to 18,000,000 gold marks, this comparing with 26,250,000 marks over ten years ago.

The *Rhenish-Westphalian Electricity Works Co.*, of Essen, reports a decline in the consumption of energy from 989,000,000 kWh in 1922-23 to 696,000,000 kWh in the past year. Despite this diminution the work of extending the power stations and the high-pressure network is being continued in view of future developments. The gold mark balance sheet shows a share capital of 185,000,000 gold marks.

The *United Aluminium Works Co.*, which is a State-owned undertaking established in 1917, has converted its paper mark capital of 130,000,000 marks to a basis of 20,800,000 gold marks. The company has the entire control over the Aluminium and Electrode Works (Erft werk) Co., of Grevenbroich, and an interest in the Rhenish-Westphalian Copper Works Co., of Olpe, and the Rhenish Sheet Metal Co., of Grevenbroich, which are already in competition with customers of the aluminium works company.

The *Voigt and Haeffner Co.*, of Frankfort-on-Main, has now approved the conversion of the capital to a gold mark basis. At the annual meeting the chairman stated that in recent months business has continually improved and the turnover now exceeds that of pre-war time. Difficulties are being encountered in connection with the export trade, owing to the scarcity of money and the unsatisfactory manner in which payments are made by customers.

French Companies.

The *Société des Exploitations Electriques* reports net profits amounting to 1,405,000 fr. for 1923-24 as compared with 1,394,000 fr. in the previous year. It is intended to pay a dividend at the rate of 17.50 fr. per share on the old capital.

The *Compagnie Générale d'Electricité* records gross profits amounting to 16,366,000 fr. for 1923-24 and net profits of 10,289,000 fr. as compared with 9,429,000 fr. in the previous year. A dividend at the rate of 70 fr. per share is to be paid, as against 60 fr. in 1922-23.

The *Société d'Electricité de Paris*, which has declared a dividend at the rate of 50 fr. per share out of net profits of 7,130,000 fr., states that an increase of about 10 per cent. in the supply has taken place in the past few months. Since 1911 the company has entered into agreements with other companies with a view to the provision of funds on joint account for the erection of a works to replace the Bercy station. As the latter has now become necessary, the company has participated in the constitution of the Electricité de la Seine, which will undertake to build the proposed new station.

The *Société Electro-Câble*, whose financial results for 1923-24 were recently recorded, states that the turnover exceeded 80,000,000 fr., as against 47,000,000 fr. in 1922-23, and the orders now on hand permit of the expectation of a still better result in the present year. A site adjoining the Argenteuil works has been acquired, and new buildings are in course of erection for the manufacture of armoured cables, the production of which will be begun early in 1925.

Prospectuses.

Sir W. G. Armstrong, Whitworth & Co., Ltd.—The list was to close on or before yesterday (Thursday) in an issue of £3,000,000 consolidated mortgage debenture stock at £99 10s. per cent., carrying interest at 6½ per cent. The issue was made for the purpose of funding floating indebtedness incurred in financing contracts for the provision of a town site, warehouses, ships and other utilities, works and services in connection with the Newfoundland Power and Paper Co., Ltd., which is expected shortly to be in profitable operation, and also for the purpose of financing other civil engineering contracts. It is anticipated that the receipts from the Newfoundland contracts alone will be sufficient to cover the whole of the interest on and redemption of the issue.

Johnson & Phillips, Ltd.—The recent issue of ordinary shares to the shareholders is stated to have been subscribed four times over.

The Northern General Transport Co., Ltd., is offering to existing shareholders 75,000 ordinary shares of £1 each at par. These will rank, *pari passu*, with the existing ordinary shares as from January 1st, 1925. The issue is made for the purpose of repaying loans and further developing the business.

Belgian Company.—*The Société d'Electricité de l'Ouest de la Belgique*, of Brussels, which is increasing its capital from 11 to 17 million francs, has just invited applications for 6,000 preference and 6,000 ordinary shares of 500 francs each. Both classes of shares are offered for subscription at 550 francs. The purpose of the issue is to increase the capacity of the plant with the object of meeting the ever increasing demand. During the past twelve months the number of consumers has increased from 9,446 to 11,952 and the mains have been extended in length from 480 to 570 miles.

Armstrong Whitworth Development Co., Ltd.—The report for the year ended September 30th last records a profit of £76,435, plus £12,400 brought forward, making £88,835. A dividend of 15 per cent., free of tax, has been paid on the ordinary shares, and the final dividend on the preference shares, making 6 per cent. for the year. A balance of £11,640 is carried forward.

Manila Electric Corporation.—A dividend of 62½ cents per share of "no par value" has been declared on the common stock for the quarter ending December 31st. The new "no par value" shares have been allotted at the rate of four to each $100 of common stock held.

Victoria Falls and Transvaal Power Co., Ltd.—The following dividends are announced:—On the preference shares: 3 per cent. for the half-year and a further 3 per cent. in respect of participating rights. On the ordinary shares: An interim dividend of 3 per cent.; all less tax.

Cork Electric Tramways and Lighting Co., Ltd.—The directors have declared a final dividend on the 5 per cent. cumulative preference share capital for the year ending December 31st, less income tax at 5s. in the £.

British Thomson-Houston Co., Ltd.—An interim dividend on the 7 per cent. cumulative preference share capital for the half-year ended December 15th, less income tax, has been declared.

Melbourne Electric Supply Co., Ltd.—A final dividend of 5 per cent. actual, free of British income tax, has been declared on the consolidated ordinary stock, making 10 per cent. free of tax, for the year.

Eastern Telegraph Co., Ltd.—Dividend at the rate of 3½ per cent. per annum, less income tax, on the preference stock for the quarter ending December, and the third quarterly interim dividend of 2½ per cent. on the ordinary stock, free of income tax.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—Interim dividend for the quarter ended September 30th of 5s. per share, free of income tax.

Pinchin, Johnson & Co., Ltd.—A dividend at the rate of 6½ per cent. has been declared on the preference shares for the half-year.

Italian Company.—*La Società Elettricità Alta Italia*, of Turin, is increasing its capital from 125 to 250 million lire.

Stocks and Shares.

MONDAY EVENING.

MEMBERS of the Stock Exchange can scarcely complain of being over-burdened with work, although they may be tempted to think that a good many of their clients are overhauling lists of investments and speculations with a view to getting rid of oddments before the close of the year. This has given a "penny bazaar" aspect to a good deal of the business that is now going on round the House. Money continues to flow into all the good securities. The extraordinary success achieved by the Greek Loan is no real criterion of investment demand, because in this case it happened that the loan came out at a very cheap price, thereby attracting the attention of thousands of stags. But in other directions, the stream of buying goes on with little abatement. This week has seen the last Stock Exchange settlement of the present

year. The next account, after Thursday in this week, will be on January 8th, 1925, a factor which in itself offers some explanation why business is of the patchwork variety.

Amongst electricity supply shares, Kensingtons stand out with the substantial rise of 22s. 6d. to 10¾. A few buyers came in and swept the market bare of floating stock. Londons, of both classes, are better. The rest of the London list has not moved. Discussion revolves around the likelihood of what dividends the London companies will receive in respect of the current year. Many people had been anticipating bumper distributions. This prophecy depended for its realisation upon the passing of the two Parliamentary Bills at the end of October last. As these were postponed, and are not likely to come before Parliament until the spring, the electricity supply boards may justifiably feel that it will be well, all things considered, to pursue a modest course in regard to the division of profits for 1924. The new arrangement, to come into force upon the passing of the Bills, would start operating in 1926, thus leaving next year free for dividing profits to the hilt if such a course were deemed desirable.

Summing up the position therefore, it may be said that the previous optimism with regard to 1924 dividends may have to undergo some modification, and that the results are likely to approximate thoese of 1923, excellent, indeed, as these proved to be. The shareholder will probably feel that this postponement suits his book admirably well, as he is likely to get bumper dividends both for this year and for next. The high-priced shares are difficult to buy, St. James', Notting Hill deferred, and Kensingtons, to quote three instances, but in most of the other cases a fair supply of shares is obtainable, and the yields they offer at the present time are worth studying in the price-lists which follow this column.

Home Railway stocks suffered a nasty jar by reason of the publication by the National Union of Railwaymen of their new wage demands. This programme was deemed so fantastic as to induce the suspicion that it was put forward for "gallery" purposes, but it upset the nerves of stockholders, and prices of Home Rails gave way sharply. In the *malaise* the Undergrounds escaped lightly. Metropolitans, indeed, are 1 up at 81½, and Districts hold their sharp rise at 55½. Underground Electric issues have gone back, the £10 ordinary shares to 2½, and the 1s. shares to 9s., though these movements simply replace the prices at the levels which they occupied a week earlier. East London ordinary has given way to 5. London Electric ordinary shares are unchanged at 6. The Great Western and the London and North Eastern are quoted by rumour as angling for control of the Metropolitan Railway. Both the big companies are already linked to the latter, the proprietors of which are in a very comfortable position.

Marconis are again a bad market, being offered at 31s. 3d., and there is no doubt that the fear of what the next balance-sheet will show is a cause for uneasiness in the minds of a good many holders. Radio ordinary at 9½ and the preferred at 10½ have become a quieter market. Canadian Marconis are 5s. 9d. American Telephone stock at 141½ is 4 points higher on the week. Automatic Telephones at 28s. 6d. for the old and 28s. for the new, now fully-paid, show little variation. International Telephones at 23s. have gone back a trifle and the new, fully-paid this week, stand at 22s. 3d., or a premium of 1s. 9d. upon the issue price of 20s. 6d.

Brazilian Tractions are heavy, going back to 56¼. The Mexican group shows no recovery, Mexico Tramway Fives being another point lower at 73, and Mexican Light and Power preferred at 55½ being 4 down. Anglo-Argentine Tramways are again better for the reason, already mentioned here, that the recent decision of the Buenos Ayres municipal council is expected to be reversed in regard to the company's concession, which, it is now hoped, will be allowed to stand. While the element of doubt remains, the prices of the shares are liable to be subject to fairly sharp fluctuations. British Electric Traction preference gained 2 points at 105½. The other stocks in the London transport list are marking time.

Cromptons moved up to 10s., and Siemens at 23s. 3d. are 9d. to the good. Edisons reacted to 6s. 3d., on completion of the support from their friends in the North who had taken a very favourable view of the outlook on the issue of the report. English Electric preference are better at 20s. 6d. This group as a whole shows noticeable steadiness.

Reference has been made to the advisability of steering clear of the Electric Light and Power Contracts Finance Corporation Preference and Short-Term Notes. These are offered by the Electricity Gas Share Debenture Investment & Guarantee Trust, Ltd. The prospectus is lacking in various salient points upon which the investor is entitled to full information. For instance, it is stated that the corporation has acquired an interest in an important power plant invention, but no particulars are given as to the date of the patent or its number. The ordinary investor will be well advised to leave the issues to those people who know most about them.

Raw rubber maintains a very firm front, and the statistical position gains strength every week. Public interest in the market is tepid, and the meagre yield offered by most of the dividend-payers is of more practical moment, at present, than the hope of what the industry will return to its shareholders when a return to normal conditions permits of the removal of restrictions upon output. Engineering and kindred shares became subdued by the unexpected offer of three million pounds 6½ per cent. debenture stock at 99½ by Armstrongs. This served to chill the market as a whole, and the tone is dull.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom. £	Dividend. 1923.	Dividend. 1923.	Price Dec. 15, 1924.	Rise or fall.	Yield p.c.
Brompton Ordinary	1	12	10	13	—	*£5 6 8
Charing Cross Ordinary	1	14	14½	2⅞	—	6 7 2
do. do. do. 4½ Pref.	1	4½	4½	17/6	—	5 3 10
Chelsea	1	10	12	27/6	—	6 8 0
City of London	1	15	15	47/6	—	6 6 4
do. do. 6 % Pref. ...	1	6	6	28/6	—	5 5 3
County of London	1	10	15	52/6	—	5 14 1
do. do. 6 % Pref. ...	1	6	6	25/6	—	5 2 9
Edmundson's Ordinary	1	7	7	22/-	—	... ...
do. 7 % Pref.	1	6	6	22/6	—	6 4 8
Kensington Ordinary	5	12	14	10⅞	+1⅛	6 10 3
London Electric	1	10	10	33/-	+6d.	6 1 3
do. do. 6 % Pref. ...	5	6	6	6½	+ ⅛	5 4 7
Metropolitan	1	8½	10	17	—	5 6 6
do. 4½ % Pref.	1	4½	4½	17/6	—	5 2 10
Newcastle-on-Tyne Ordinary ...	1	2½	6	22/6	—	5 9 1
do. 5 % Pref. ...	1	5	5	18/9	+ ⅛	5 6 8
do. 7 % Pref. ...	1	7	7	25/-	—	5 12 0
Notting Hill 6 % Pref.	10	6	6	9⅝	—	6 4 5
North Met. Elec. 6 % Pref. ...	1	6	6	1⅛	—	5 6 6
Urban Ordinary	1	—	4	19/3	—	4 4 0
do 6 % Pref. ...	1	5	6	19/6	—	6 0 1
St. James' and Pall Mall ...	5	14½	17½	12¾	—	6 16 0
South London	1	11	15	2½	—	6 13 4
South Metropolitan Pref. ...		7	7	1½	—	5 12 0
Westminster Ordinary	5	12	15	11	—	6 16 4
Whitehall Elec. Invst. 7½ % Pref.	1	7½	7½	19/-	—	7 18 0

HOME RAILS.

Central London Ord. Assented	Stock	4	4	73	—	5 12 0
Metropolitan	,,	8½	4	81½	+1	4 18 2
do. District	,,	8	8½	55½	—	6 6 2
Underground Electric Ordinary	10	Nil	Nil	2½	— ¼	Nil
do. do. "A" ...	1	Nil	Nil	9/-	— 6d.	Nil
do. do. Income Bonds	5	6	6	99	—	*6 1

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	105	—	5 14 3
do. Def.	,,	1½	1½	24½	+ ¼	6 2 5
Chili Telephone	5	6	6	8¾	—	*5 4 4
Cuba Sub. Ord.	10	7	7	7	—	10 0 0
Eastern Extension...	10	10	10	17	—	*5 17 8
Eastern Tel. Ord.	Stock	10	10	170	—	*5 17 8
Globe Tel. and T. Ord.	10	10	10	17½	—	*5 16 0
do. do. Pref. ...	10	6	6	11⅛	—	5 7 10
Great Northern Tel.	10	24	22	30	—	7 6 8
Indo-European	25	7	7	32½	—	*5 6 1
Marconi	1	15	10	31/3	— ⅛	6 8 0
Oriental Telephone Ord.... ...	1	12	12	1⅝	—	*5 8 0
United R. Plate Tel.	5	8	8	6½	—	*5 15 5
West India & Panama	10	Nil	Nil	1/-	—	Nil
Western Telegraph		10	10	17½	—	5 14 3

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	12½	5½	8⅜	+ ⅛	5 16 0
do. do. 2nd Pref. ...	5	5½	6	9⅛	+ ¼	9 16 0
do. do. 5% Deb. ...	Stock	5	5	73½	—	6 16 0
British Electric Traction Ord. ...	,,	5	5	99½xd	—	6 0 0
do. do 6% Pref. ...	,,	6	6	105½xd	+2	5 13 0
Brazil Traction	100	4	4	56½	— ½	7 1 7
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	88½	—	5 13 0
do. do. Preferred	,,	5	96/-	89½	—	*5 7 6
do. do. Deferred	,,	5	129/5	111½	—	*5 16 0
do. do. Deb.	,,	4½	4½	80½	—	5 5 7
Lond. & Sub. Trac. 5 % Pref. ...	1	5	2½	7/-	—	7 2 10
London United Tram. Deb. ...	Stock	4	4	56½	—	7 1 7
Mexico Trams. 5% Bonds ...	—	Nil	5	73	—	6 17 6
do 6% Bonds ...	—	Nil	Nil	58	—	Nil
Mexican Light Common ...	100	Nil	Nil	23	—1	Nil
do. Pref. ...	100	Nil	Nil	55½	—4	Nil
do. 1st Bonds ...	—	6	6	66	—	7 11 6

MANUFACTURING COMPANIES.

Babcock & Wilcox...	1	20	12	2⅞	—	*4 18 6
British Aluminium Ord.... ...	1	5	5	28/9	—	5 1 8
British Insulated Ord.	1	15	15	56/3	—	5 9
Callenders	1	15	15	2½	—	5 6 9
do. 6% Pref....	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	5	Nil	10/-	+ ⅛	... ...
Edison-Swan	4/-	7½	10	6/3	—6d.	6 8 0
,, 5% Deb.	Stock	5	5	83½	—	5 19 0
Electric Construction	1	10	10	30/-xd	—	6 13 4
English Electric	1	5	5	19/3	—	5 4 0
do. do. Pref.	1	6	6	2./6	+6d.	5 17 1
Gen. Elec. Pref.	1	6½	6½	23/3	—	5 11 10
do. Ord.	1	5	5	21/-	—	4 15 3
Henley	1	15	15	2½	—	5 6 9
do. 4½ Pref.	5	4½	4½	4½	—	5 0 0
India-Rubber	1	10	5	17/6	—	*5 14 3
Met.-Vickers Pref....	2	8	8	9½	—	6 0 0
Siemens Ord.	1	5	—	23/3	+9d.	4 6 0
Telegraph Construction	12	20	20	26½	—	*4 10 0

*Dividends paid free of Income Tax.

Power Transmission Lines: Aspects of their Design.—VI.*

By WILLIAM T. TAYLOR, M.Inst.C.E., M.I.E.E., Fel.Am.I.E.E.

As already pointed out, in order to determine the most economical line support, it is necessary to determine the total first cost of construction per unit length of the line. However, it is not only necessary to compare the costs of different materials used, such as wood, steel or iron and reinforced concrete, or the different kinds of line supports, such as *single* poles, frames or wide base structures, but it is also necessary to include the total costs of insulators, pins, line hardware, fittings, &c., which will vary according to the number of line supports and terminal poles or frames used; moreover, a comparison should be made on the basis of different spans and of annual costs.

As regards wayleaves, a right-of-way costs anything up to £50 or more per mile of route. The cost for digging holes varies according to the country and labour costs, and to the location and nature of the ground, *i.e.*, rock, earth (frozen and otherwise), chalk, &c. The cost of freight and haulage is variable, depending upon the location of the line and its accessibility, the country, &c. Both material and labour costs fluctuate, and a line construction may be subjected to the maximum items of costs, such as expensive right-of-way, high cost of clearing, rock foundations all along the route of line supports, and the materials may require extra handling and extra haulage, &c. So variable are these items of cost that it would not be safe to give figures to cover most cases for predetermining the cost of overhead lines to suit the different countries, &c.

In a study of comparative costs and the use of different materials, such as steel or wood poles, it is not only necessary to know the saving per mile of line (saving in fixed charges *and* in first cost), but it is also necessary to be well assured of the comparative life of the materials used. To simply compare the price of a steel line support and a wood line support and stop at that is anything but right. The most economical pole line will have the lowest annual cost, and the most economical investment will produce the highest earning power for the amount of money spent.

For high-voltage work in particular, the insulation factor must be high, and long pole spacings are the most desirable, as they reduce line interruptions, due to the decreased number of insulators in service. Any extra expense in the selection of line insulators is generally well spent. They should be selected on the basis of competitive tests and upon operating performance as judged by other undertakings, rather than upon a price basis. Some companies use much larger insulators than are really necessary for the voltage. One must consider not only the cost of the insulator and the cost of replacing it in the damaged part of the line, but also the loss of revenue during the time the line is out of service and the loss of confidence on the part of the consumer. In general, a cheap high-voltage insulator is an expensive insulator in any line. The suspension type of insulator is known to deteriorate in the storeroom as readily as on the line; at the present time it is estimated that its life is usually slightly less than that of the pin type insulator.

The approximate cost per mile of wood pole line, single three-phase circuit *construction* (which includes total labour costs for digging, erecting, fitting, distributing and stringing of conductors), varies with the voltage, &c., from about £25 to £55; for two three-phase circuits on the same pole, the cost varies from about £30 to £60 per mile of line up to the maximum permissible voltage. The actual total cost per mile of wood pole line depends upon the voltage, span, system, number of circuits, price of materials used, locality, climatic conditions, and factors of safety used. It would be futile to give costs sufficiently accurate for reference, as costs for the different variables involved change into so many different forms due to the different items of costs going up or down and are never exactly coincident in respect of the different items for different cases.

In this country the choice of span may mean a great saving in rent for way-leaves (right-of-way), and may pay the *interest* on the increased cost of larger line supports. The *actual* cost will not only depend upon the conductor loading of the line supports, but upon the allowable factor of safety, the type and kind of line supports, the nature of the route, and, in so far as the economic span is concerned, the actual cost will depend upon the then ruling prices for line materials. Up to certain ultimate strengths, wood line supports are cheaper than steel line supports, but their relative annual costs are different, differing widely with the kind and quality of preservation, soils, climatic conditions, &c. For spans above about 400 ft., steel poles with copper conductors usually come out cheaper than wood poles spaced about 240 ft. and under. If the load upon a wood pole be increased by increasing the span or by increasing the number of conductors, the *actual* life of the pole will be reduced more in proportion to that of a steel pole; on the other hand, due to the way wood poles are rated compared with steel (which is manufactured and not grown, hence the closeness of rating for steel) they generally carry much more load in relation to steel poles chosen for the same service. Provided the cost of right-of-way is reasonable for short span, aluminium conductors on wood poles may be the cheapest construction.

The cost of a pole complete with all the necessary line materials such as insulators, arms, pins, &c., ready for the conductors, is independent of the cost of wayleaves, surveying, pole rights, clearing of route, freight and hauling, and therefore these latter items of cost should be treated independently. The line conductor should also be treated independently as, with an increase in its size or an increase in the amount of power to be delivered for a given delivered voltage, the size of pole for a definite spacing of line supports, increases in diameter. About the best that can be done is to show, in tabular form, approximately reliable figures of construction costs per mile of line in percentage values for different standard line voltages, each set of costs being for a given system and given number of circuits and for the most common or for different pole and span lengths, respectively. Such a table may reasonably serve as a rough practical guide in preparing estimates of line construction costs. Obviously, all such tables and data should be used with caution for the reason, among others, that above certain sizes of conductor the cost of a pole increases for a fixed span length, also because certain sizes and lengths of line materials (such as cross-arms and general line hardware) can be used for a wide range of line voltages, and for the next higher voltage the cost may show, without any apparent cause, a sudden jump upwards.

As an illustration of the meaning of the above remarks, take a fixed size of wood pole 35 ft. in length carrying one three-phase circuit, with spans of 125 ft. between poles, the cost per mile of line (excluding cost of wayleaves, surveying, engineering, clearing of route, haulage and delivery, and cost of conductors, and

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assuming 100 per cent. total cost in respect of each line voltage) as found from experience of many cases is approximately:—

Voltage	(a)	(b)	(c)	(d)	(e)	(a)+(b)+(c)+extras.
3,300-6,600	13.79	60	23	100	100	100
10,000	16.77	57	22	104	112	100
15,000	20.82	54	21.5	110	115	100
20,000	25.63	50	20	116	129	100
30,000	27.885	42	16.0	145	168	100
40,000	47.20	36	14.0	168	200	100
50,000	53.2	30.0	12.0	193	—	100
60,000	65.35	20.0	8 5	286	—	100

the columns relating respectively to:—

(*a*) Materials cost in per cent., including line insulators, pins, cross-arms, line hardware, iron braces, galvanised-iron staying wire. This item of cost increases due to the increase in cost of insulators with increasing voltage.

(*b*) Wood poles. This percentage cost is for the same pole diameter through the range of voltages given. A larger diameter of pole need not necessarily be required, as the size of conductor for a given delivered load decreases with increase in voltage; on the other hand, for a given distance, the voltage is usually increased with the increase in amount of delivered load, but the size of conductor required may, nevertheless, be the same. This item of cost is shown to decrease with increasing voltage for the reason that it is based on the total cost, which increases with the voltage for any given size of line support; see below.

(*c*) Construction percentage cost, including digging, fitting, erecting, distributing of insulators and materials, and stringing of line conductors. The item of cost is shown to decrease with increasing voltage for the reason that it is based on the total cost, which increases with the voltage for any given span length of line supports, &c.

(*d*) Relative percentage increase in cost, taking the cost of 6,600-volt, three-phase line at 100 per cent.

(*e*) Ditto for two three-phase circuits on the same pole.

It must not be overlooked that the cost per mile of single, three-phase circuit, wooden pole line using 35-ft. poles and average spans of 125 ft., varies for the different countries, localities, line voltage, and the kW delivered, &c. At the present time the cost per mile for such lines—*excluding* such costs as wayleaves (right-of-way), clearing, freight, hauling to site, line conductors—will vary in values for the different countries and localities between:

£100—£175 for a 3,300-6,600-volt line.
£115—£185 for a 10,000-volt line.
£125—£195 for a 15,000-volt line.
£135—£210 for a 20,000-volt line.
£160—£270 for a 30,000-volt line.
£190—£320 for a 40,000-volt line.
£220—£380 for a 50,000-volt line.
£260—£475 for a 60,000-volt line.

Take the following for the purpose of roughly estimating a given case, assuming actual costs are not available:—

CASE:

What is the approximate cost per mile of line hardware, cross-arms, pins, insulators, and poles? Also the construction cost per mile of line for digging holes, erecting, fitting, distributing of insulators and line materials, and stringing of line conductor of a single three-phase 30,000-volt circuit on 35-ft. round wood poles spaced at an average span of 125 ft.? The line is to be carried far into the country and through territory where 8 lb. of wind and $\frac{1}{4}$ in. ice can be expected. Taking the cost (due to location, loading, &c.) at £250 per mile of line—not including the cost of line conductor, which is dependent upon the delivered load, we may obtain the respective percentage line cost items

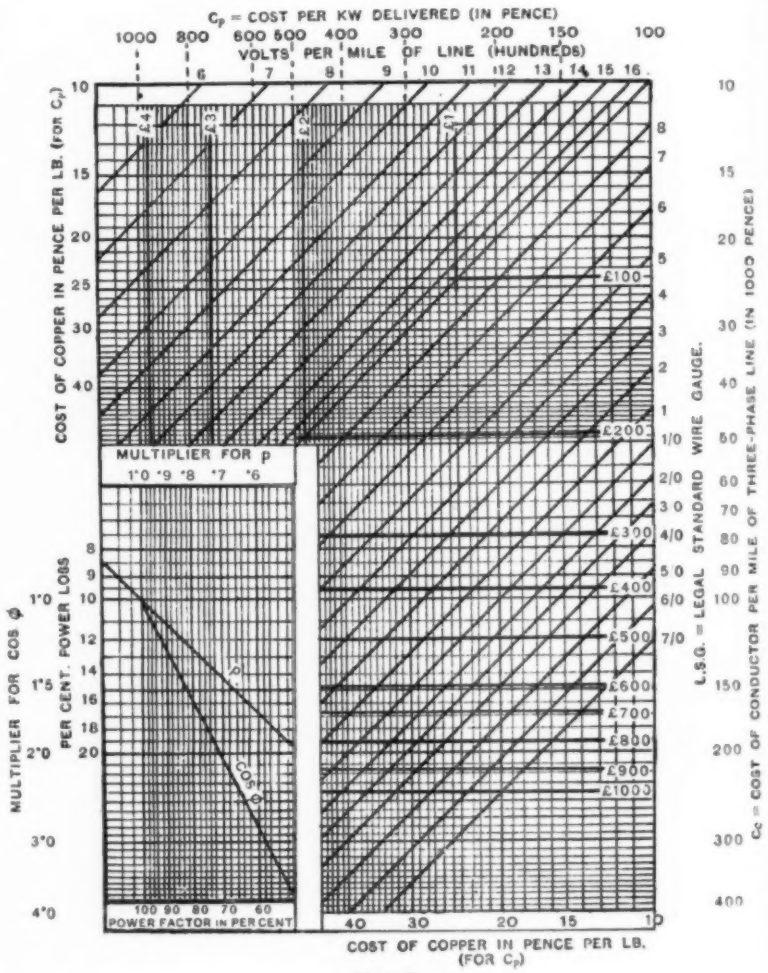

C_p = COST PER KW DELIVERED (IN PENCE)
1000 800 600 500 400 300 200 150 100
VOLTS PER MILE OF LINE (HUNDREDS)
6 7 8 9 10 11 12 13 14 15 16
COST OF COPPER IN PENCE PER LB. (FOR C_p)
£4 £3 £2 £1
£100 £200 £300 £400 £500 £600 £700 £800 £900 £1000
MULTIPLIER FOR p
1·0 ·9 ·8 ·7 ·6
MULTIPLIER FOR COS Φ
PER CENT. POWER LOSS
p
cos Φ
100 90 80 70 60
POWER FACTOR IN PER CENT
40 30 20 15 10
COST OF COPPER IN PENCE PER LB. (FOR C_p)
L.S.G. = LEGAL STANDARD WIRE GAUGE.
C_c = COST OF CONDUCTOR PER MILE OF THREE-PHASE LINE (IN 1000 PENCE)

Chart X.

from the above table, thus: *Cost per mile of pole-line, erected and completely fitted (excluding line conductor)*:

Line materials (27.885%) ...	£94.7	
Poles (42%)	105.0	
Construction (16%)	40.0	
		——£239.7
Plus extras		10.3
Total cost ...		£250.0

For any given line, the length of conductor is *independent* of the number of poles and the span lengths; however, for a given span, the diameter and the cost of pole increase with the increase in size of conductor, hence the cost of poles increases with the increase in cost for conductors of a given metal. The cost of conductor is an important item as a basis in the determination of its size for a given set of circuit con-

ditions, and also for estimating the most economical line. The cost of conductor also varies with the ratio of volts per mile of line, and the cost per kW delivered varies with the purchase price of the conductor chosen. As a matter of fact, the cost of conductor varies with the distance of transmission, power and voltage delivered, power factor of the load, and the power line loss; actually, apart from the ruling price for metal (copper or aluminium), the cost of line conductor varies directly as the square of the distance of transmission and directly as the square of the kW load delivered and inversely as the square of the power factor of the load and the delivered voltage, and inversely as the percentage power lost in the line. For a given ratio of volts per mile, the cost of the delivered power in kW will increase with the increase in the price of metal (copper or aluminium) used, and with the increase in the load power factor. For a fixed price of line conductor, a decrease in the ratio of volts per mile will result in an increase in the cost of delivering a given amount of power, and *vice versa*; moreover, the same conditions will bring about an increase (or *vice versa*, a decrease) in the percentage power lost in the line.

The economic line depends upon the cost of the line conductor and the kW-year loss in the line. The *most economical line* depends upon the most economical line voltage, the most economical span length of line supports, the most economical size of conductors, and the most economical phase compensation. It can be arrived at only after a careful analysis of all conditions to suit any given case—and one given case generally; one given set of conditions may be useless for another case. Instead of using electrical calculations for obtaining size of conductor and the economic line, we may take the problem simply from the viewpoint of cost of conductor per lb. or ton weight, the economic span length, and the cost of power loss per kW-year. To obtain the size of conductor from the cost and power loss in the line, Chart X has been prepared.

In making the economic calculations, estimates should be prepared on the basis of costs per mile of line, giving different sizes of conductors and different loads, with varying spacing between line supports. Closer spacing means more insulators and line materials, and the cost per mile of line may show a much greater increase than that caused by the increased size of conductor alone. There is also the question of the *lowest* factor of safety allowable against horizontal loads. If the sizes of conductors are increased and the span lengths left the same, the line may be relatively weak against horizontal loads; the best conditions conforming with the specified factors of safety must be reached. The different sizes of conductor for different values of line power loss, in terms of the commonly specified factors (system, receiver power, voltage and power factor, transmission distance) can be obtained from Chart I. The annual charges per mile of line is then calculated on the basis of annual interest, for wood pole lines (say 6 per cent.), depreciation annuities (say 7 per cent. compounded), maintenance (say 70 per cent. of the depreciation), and taxes (say 0.8 per cent.); the results are then plotted against the total annual cost (in pence per kW-hour) of the power lost per mile of line. With this information available, it is simply a matter of plotting curves to show the annual cost, different sizes of conductor, and the cost of power lost for a given load or different loads: the point of the curves showing the *economic line* is obtained at a glance.

To find the size of conductor when the market price of copper is known, Chart X has been prepared. This chart will be found useful for determining—

(1) C_c = Cost in £ or pence per mile of three-phase line with copper conductor selling at from 10 to 50 pence per lb.

(1a) C_c = Ditto for aluminium by taking copper conductor as 3.3 times the weight of aluminium conductor for equal area or gauge number. That is to say, weight per yard per sq. inch cross-section, in lb., is 11.7 for copper and 3.52 for aluminium, or ratio of 11.7/3.52 = 3.33. Thus, taking a No. 4 L.S.G. bare copper wire at 2,580 lb. per mile of three-phase circuit, then 2,580/3.33 = 770 lb. weight of aluminium wire per mile of three-phase circuit.

(2) C_p = Cost in £ or pence per kW delivered (at 100 per cent. power factor) in terms of line volts per mile of line and on the basis of 10 per cent. power loss.

NOTE.—For any other power loss (p) or any other power factor ($\cos\phi$), multiply chart values by respective *multipliers* for the given or required value of p (given in chart for power loss values from 7.5 to 19.5 per cent.) or $\cos\phi$ (given in chart for power factors from 100 down to 50 per cent.).

Solution of the following problem will demonstrate the use of the chart:—

GIVEN:

One three-phase (3-wire) overhead line.

Voltage at the receiver ...	30,000 volts.
Length of line	27 miles.
Load at receiver	2,150 kW.
Power factor of load ...	80 per cent.
Line power loss	10 per cent.
Price of copper conductor ...	12 pence per lb. (£112 per ton.)

FIND the size of conductor.

The ratio of volts per mile is 30,000/27 = 1,111; then from Chart X (upper part), with copper selling at 12 pence per lb., cost is seen to be C_p = 268 pence per kW delivered at 100 per cent. power factor.

For 80 per cent. power factor, Chart X shows multiplier to be 1.56, hence, actual cost per kW delivered (due to difference in load power factor) is 268 × 1.56 = 418 pence = £1 14s. 10d.

For 27 miles of line we have 418 × 2,150 = 898,700 pence = £3,744.6 Cost per mile of line is 898,700/27 = 33,300 pence = £138.75; *allow 6 per cent. for sag and underestimation of length, &c.*, total 35,300 pence.

From Chart X (lower right section) we find size of conductor corresponding to copper costing 12 pence per lb. and total cost per mile of line of 35,300 pence, to be No. 4 L.S.G. bare hard-drawn copper wire.

Opinions differ as to what is considered a fair estimate of durability and the corresponding per cent. annual depreciation, &c., of the various parts of a power transmission system. Taking the annual depreciation on a 4.5 per cent. compound basis of interest and the maintenance cost as 80 per cent. of the depreciation charges, we have for the total annual expenses for line conductor:—

Cost Item.	(a)	(b)	(c)	(d)	(e)	(f)
Copper—	20	6.0	0.9	3.187	2.5496	12.637
Conductor	30	6.0	0.9	1.639	1.312	9,851

wherein
(a) = life range, in years.
(b) = interest, in per cent.
(c) = taxes, in per cent.
(d) = depreciation, in per cent.
(e) = maintenance, in per cent.
(f) = total annual expenses, made up of the sum of interest, depreciation, taxes, &c.

Let (f) = 10 per cent., then, taking the cost of line conductor only (not the actual value it represents in the line which includes construction costs), we have cost of 27 miles of three-phase line conductor, £3,745, or £138.75 per mile, with copper selling at 12 pence per lb.; this is for a line power loss of 10 per cent., or 215 kW, involving a cost of, say, £10 per kW-year to produce on the line, but selling at, say, £50 per kW-year. The annual charges on the conductor at, say, 10 per cent., is £374.5, and the value of the lost energy (based on the cost to produce) is 10 × 215 = £2,150 per year. The line losses, if sold at £50 per kW-year, would bring 50 × 215 = £10,750 per year. Now, in order to reduce this high figure (£10,750) by, say, 50 per cent., it would be necessary to double the size of conductor, or to add £374.5 to the annual expense cost. On this

reasoning it is evident that if the extra investment in copper of £3,745 can save 107.5 kW *continuously*, the energy of which can be produced for £10 per year per kW, it is clearly a mistake not to do it. However, first of all we must be certain that the anticipated load factor will warrant this, and we must be assured that the line supports will withstand the extra loading for the given spans, or, assuming the line supports have already been ordered, then we must calculate what span length will conform with the net safe transverse load strength of the line support for double the size of conductors; a solution of both these problems (not taking into account any further cost for insulators, line hardware, &c.) can be obtained from Chart IX.

When this has been done, then determine the cost and size of line for the new condition, *viz.* $(107.5/2{,}150)\times 100 = 5.0$ per cent.* power line loss, other conditions remaining the same as given in the previous example. Therefore, with the cost of conductor and load power factor remaining the same, we get $C_p = 418$ pence per kW delivered, assuming 10 per cent. power loss. Then, for 5 per cent. power loss we have $418 \times (10/5) = 836$ pence per kW delivered, or double the cost. Total line conductor cost is $836 \times 2{,}150 = 1{,}797{,}400$ pence = £7,490; or $1{,}797{,}400/27 = 66{,}570$ pence = £277.5 per mile of line (allow 6 per cent. for sag, &c.), we have 70,560 pence. From Chart X, the size of conductor is seen to be No. 1/0 L.S.G.

* The cost varies inversely as the power loss expressed in per cent.; the value for 5 per cent. is not shown in Chart X.

Hydro-Electric Development in Venezuela.

IT is now close upon fifteen years since we published some brief details of one of the earliest hydro-electric stations in Venezuela—that of the Sociedad de Electricidad de Valencia. The plant is located at Aguacatal, up in the mountains about 16 miles from the town of Valencia, where an ample supply of water is available, and has proved successful both from the technical and financial points of view. When started in 1909, the plant comprised two Escher-Wyss 250-h.p. turbines, coupled to 225-kW Siemens-Schuckert three-phase alternators. As the demand for electricity for both lighting and power purposes in the town of Valencia developed, it became necessary to put in a third turbo-generator set of similar power and construction. This additional set was originally intended as a reserve installation in case of breakdown, but was soon called upon to take its part in meeting the demand, the output of the three sets having for some time aggregated 3,000,000 kWh per year. During 1923 it became evident that further extensions were necessary, and after careful surveys it was decided to establish an entirely new small station higher up the mountain at a point known as El Milagro.

Fig. 1.—Pipe Intake, Canal, and part of Reservoir.

A dam was first constructed below one of the falls, the water being led therefrom to the pipe intake by a concrete canal three-quarters of a mile in length and 2 ft. in depth and width. From the intake a steel pipe-line 1,100 yards in length and varying in diameter down the mountain side from 55 to 40 cm. (21.6 to 15.7 in.) conducts the water to the power station. There are altogether 330 pipes, each pipe being supported by a pillar, with a concrete anchor block under every tenth pipe.

As it was found that, with the dam about 4,500 ft. above sea level, and consequently frequently above the clouds, there was considerable variation in the water supply, and as also the mountain is of a loose character giving rise to landslips into the canal, it was found necessary to modify the arrangements at the intake end of the canal by the provision of a water storage reservoir of nearly two million gallons capacity. The canal now terminates in a forked portion, one branch leading to the tank supplying the pipe-line, and one conducting any surplus water in abundant supply periods to the reservoir, which has a separate outlet to the pipe-line tank.

The plant at the new El Milagro power station at present consists of an Escher-Wyss turbine developing 570 h.p., with a head of 852 ft., coupled direct to an Oerlikon 475-kVA three-phase generator, but space is available for the installation of a further set of the same capacity when required.

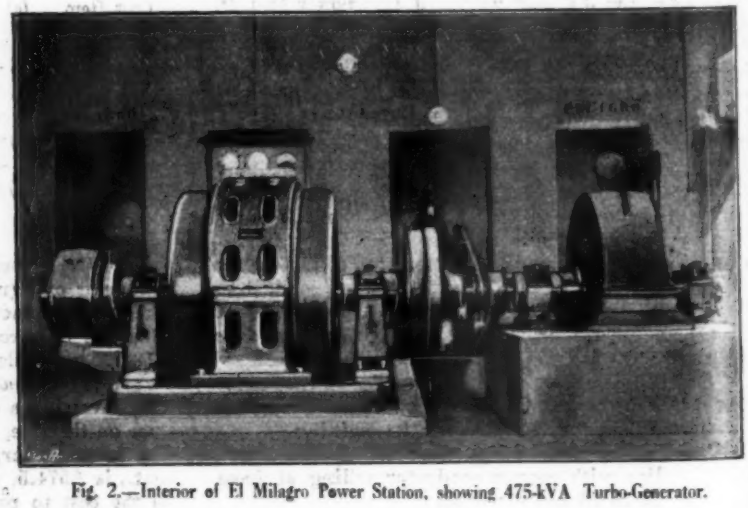


Fig. 2.—Interior of El Milagro Power Station, showing 475-kVA Turbo-Generator.

The El Milagro plant has been running since May of the current year. At first the results obtained were

disappointing, as not more than 50 per cent. efficiency could be obtained. As a result of investigation, however, it was found that the trouble arose from the blocking-up of the valves by leaves from trees. Steps have been taken to prevent a repetition of this trouble, and the set is now working steadily at the efficiency guaranteed by the makers.

In view of the fact that the work has all been carried out in a wild, barren district over 4,000 ft. above the sea, and that owing to the absence of roads, practically the whole of the material had to be transported up the hills by mules, great credit is due to those responsible for the undertaking.

Ionisation in the Atmosphere.

THE Physical Society of London held a discussion, jointly with the Royal Meteorological Society, on November 28th, on the subject of "Ionisation in the Atmosphere, and its Influence on the Propagation of Wireless Signals."

Dr. W. H. ECCLES, F.R.S., delivered the opening address, giving a brief history of wireless telegraphy in relation to atmospherics, and an outline of the parts that might be assigned to diffraction, the Heaviside layer, and ionic refraction. Certain facts, such as the errors of direction finding at night, and the success of long-distance transmission using short wave-lengths, were quoted as offering confirmation of the hypothesis of an ionised layer in the upper atmosphere.

A paper on "Atmospheric Ionisation and its Variations" was read by Dr. C. CHREE, F.R.S., in which the author dealt with the potential gradient, the numbers of positive and negative ions and the charges carried by them, the conductivity of the air, and the vertical air-earth current. Particulars were given of the annual variations observed at various stations.

A paper on "Geophysical Influences on the Transmission of Wireless Waves" was read by Prof. E. V. APPLETON, M.A., D.Sc., who summarised the facts of short- and long-distance transmission for long and short waves, and gave examples of signals whose variability might be attributed to the varying phase and amplitude of rays ionically refracted by the upper atmosphere. The strong night signals were attributed to a lower atmosphere devoid of excessive ionisation. The author held that the facts of wireless telegraphy, as set forth, showed that the atmosphere exerted a variable but usually favourable influence on wave propagation.

A paper on "Atmospherics" was read by Mr. R. A. WATSON WATT, reviewing data as to the nature and origin of atmospherics obtained in the course of a fundamental investigation of atmospherics undertaken by the Radio Research Board. Even with the limited data available, relations with thunderstorm phenomena, precipitation, or barometric minima have been traced in 87 per cent. of 490 cases, distributed over Europe, the Mediterranean, and North Africa. The tracing of a "cold front" for 40 hours over 2,000 km. across Western Europe, by directional recording of atmospherics, was recorded.

In a paper on "The Electric Field of a Thunderstorm and Some of its Effects," Mr. C. T. R. WILSON, F.R.S., pictured a thundercloud as having its upper and lower regions oppositely charged, the positive charge being most commonly on the lower side. The cloud lies at a moderate distance above the earth, while the Heaviside layer lies at possibly 100 km. above the earth. A lightning flash constitutes a short-circuit, in the absence of which the charges may leak away to the earth and the Heaviside layer respectively. Three possible causes of ionisation were suggested: (1) The charges on the cloud may ionise by induction at heights where the density of the air is very small. An ordinary cloud may have a sufficient electric moment to produce a similar effect, since this moment may be great even where the charges themselves are small, provided that the charges are separated by a great depth. (2) Beneath a thundercloud there is an intense potential gradient, producing a heavy earth-air current; the intensity of this current is hidden near the earth by the fact that part of it passes upwards through trees and the like. (3) The radio-active matter in the atmosphere produces β-particles whose energy, under the influence of the immense potential differences available, may be so great as to impart to the particles a kinetic mass equal to the mass of hydrogen atoms.

A paper on "The Evidence of Terrestrial Magnetism for the Existence of Highly Ionised Regions in the Upper Atmosphere" was read by Prof. SYDNEY CHAPMAN, F.R.S.

General Discussion.

Dr. G. C. SIMPSON stated, in connection with Prof. Appleton's paper, that the strength of signals received from a sea station had been observed at Slough and at Orfordness, the latter station lying about half-way between the other two. During the daytime there was no substantial error in the direction found by either of the land stations. At night there was no error at Orfordness, where the signal was received purely over the sea; but at Slough a large variation in intensity and apparent direction was introduced by the land passage. It seemed incredible that for three stations so close together such a marked difference could be caused by a conducting layer 60 km. up, and the latter also failed to account for the effect of the change from daylight to dark. Mr. Watt had shown that atmospherics might originate where there was no thunderstorm, but an atmospheric demanded an electric discharge of some sort. What could be the nature of such a discharge in a cloud which was not a thunder-cloud?

Prof. C. L. FORTESCUE pointed out that the authors assumed a more or less sudden transition from the middle, non-conducting atmosphere to the conducting layer. Mr. Wilson's discussion of the state of things existing above a cloud connected this transition with that from a region of stable to one of unstable ionisation. Similarly, in a high-pressure cable, the inner layers of insulation might be practically conductive. From Mr. Watt's paper it was particularly interesting to learn of the fine structure of atmospherics. Previously the speaker had been much puzzled by the apparently low-frequency wave-form of an atmospheric, which was quite inadequate to account for the shock produced in an aerial. The fact that 87 per cent. of atmospherics had been traced to meteorological disturbances relieved them from having to postulate a source of atmospherics outside the atmosphere.

Dr. J. ROBINSON said that very little had been heard that evening about the effect of the earth's conductivity, yet the importance of this was shown, for instance, by the experiment of Dr. Smith-Rose quoted by Dr. Simpson on the passage of wireless signals over land and over sea. A type of propagation formula different from those hitherto considered, would apply to signals sent from one aeroplane to another. It is known that transmission between 'planes was better than transmission between ground stations, and, further, that with a wave-length greater than the natural wave-length, end-on propagation occurred. Facts like these appeared to demand experimental investigation.

Dr. W. H. ECCLES, in closing the discussion, said the discussion had shown that the subject of atmospheric ionisation was so very wide that there was difficulty in grasping all the facts and seeing their connection with one another. The broad questions left unanswered were: How many conducting layers are there in the atmosphere? What is the position of each of these layers? Which of them function in the propagation of wireless waves? In which of them reside the sources of the strays or sturbs that trouble the wireless telegraphist?

So far as radio-telegraphy was concerned, Prof. Appleton and Dr. Simpson had cited observations which proved the great influence of land and sea and of the air above them. That the air had an influence might be expected from the data of atmospheric conductivity discussed by Dr. Chree. It was proved also by the observed connection between weather and signals. For instance, tropical storms caused variations of signal strength; the variations resembled those produced by solar eclipses, in which the darkening of the air improved transmission. The question arose: Was the terrestrial magnetician's ionised layer the same as the wireless man's? They were still undecided. As a fact, the wireless man and the magnetician each wanted at least two conducting layers. Wireless phenomena could scarcely be understood at all without the aid of, first a world-wide permanently ionised layer; and, secondly, a lower layer subject to daily ionisation; magnetic variations could not be explained without the aid of a world-wide layer ionised daily together with a layer permanently ionised and mainly confined to the polar regions. The disparity between their requirements was at first sight regrettable, but it would doubtless lead to interesting hypotheses and discoveries.

No connection had anywhere been observed between magnetic storms and wireless. This seemed to indicate that wireless waves did not penetrate into the auroral layer. Perhaps the bottom of this layer, at a height of about 100 kilometres, was the impenetrable quasi-reflecting ceiling named after Heaviside.

They must thank Dr. C. T. R. Wilson for his illuminating suggestion that thunderclouds might by their electrostatic field ionise the rarefied air beneath a high conducting layer. This might help to elucidate the fact that strays or sturbs were often produced without visible lightning, and that a thunderstorm between two stations frequently affected intercommunication.

The PRESIDENT said that, while the discussion had been of great interest, it had not brought out all the information that was wanted.

Electricity and Plants.—An interesting experiment is at present being carried out at the Christchurch (N.Z.) Botanic Gardens by Mr. James Young, curator, with a set of electric lamps in one of the propagating houses, with a view to forcing the growth of a number of annuals. The plants are given five hours' additional light daily, and by way of comparison similar plants are being grown under normal conditions. According to the *Industrial Australian and Mining Standard*, those grown beneath the electric light made, on an average, a 25 per cent. greater growth than the others.

Domestic Applications of Electricity.

By T. HALL.

(*Abstract of paper read before the* EAST-MIDLAND CENTRE *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

THE Electrical Development Association has by means of exhibitions, advertising literature, the collection of data on experience in operation of various domestic appliances, &c., done invaluable work, and much of the progress made throughout the country in the last few years must be placed to the credit of this very useful Association. It cannot succeed in its work unless the manufacturers of apparatus, the electricity supply authorities, and the contractors, all pull together with the one slogan: "Use electricity for everything."

The public want electricity, and are asking us to-day to solve all kinds of propositions, some of which, from an electrical point of view, would have been considered impossible a few years ago; but we have got to tackle these problems and, if necessary, the undertaking should risk the cost of installation to demonstrate what can be done, the consumer being asked to pay only when the experiment has proved entirely satisfactory. It is of no use sitting in an armchair and expecting this class of business to come along automatically. A live showroom and sales department run on sound business lines is absolutely indispensable. Its essential feature is to see that the consumer has the most reliable and efficient apparatus it is possible to procure, especially as the public can be so easily misled into buying very inferior appliances. Apparatus should only be stocked which carries the makers' guarantee and can be easily repaired in quick time.

Actual users of electrical current-consuming and labour-saving appliances are now our best advertisers, and they are not the people who can afford expensive luxuries. We must obtain the lighting business *first*, and then endeavour to induce the consumer to take other current-consuming apparatus. Supply authorities and contractors should seize every opportunity to bring consumers' lighting installations into line with present-day practice. The field for lighting is still a large one, as probably not more than 20 per cent. of the houses in this country are wired for electric light.

The wiring of the house is *most important*; if the house is not already wired the position of the points should be carefully thought out to ensure the maximum of comfort and economy. On new installations it is of the utmost importance to persuade the consumer to install heating and lighting plugs in as many rooms as possible; once plugs have been installed the sale or hire of the heavier current-consuming appliances is rendered much easier.

In Burton, whenever possible, we draw up specifications for new consumers, and endeavour to give the best lighting effects having regard to the consumers' tastes, whilst heating plugs are invariably installed.

The late-hour window lighting scheme, due to the persistent efforts of the Electrical Development Association, has now been taken up extensively throughout the country. Owing to the earlier closing hours of shops the general adoption of this system will considerably increase the lighting consumption and load factor, in addition to being a spendid advertisement to both the tradesman and the supply department.

Electric heating is now making rapid progress, and in Burton is coming along quite as fast as it is possible to cope with it. It is best to install a fire that will quickly raise the temperature of a room, and for living rooms it is best to allow approximately 1¼ to 2 watts per cu. ft. The majority of the fires put on the mains are of 2¼ to 3 kW capacity. For a room which has to be heated all day long I consider that at present average rates of 1d. to 1½d. per kWh it is not advisable to push electric heating in preference to a coal fire. For rooms, however, which only require heating for a few hours per day there is nothing to compare with electricity for convenience, cleanliness and economy.

I do not find that there is any appreciable increase in the peak load due to residence heating as practically all consumers use a coal fire for the living room, the electric fires being used at odd times.

Inquiries have been received for the electric heating of churches and chapels, but notwithstanding efforts to meet the authorities in the cost of installation, the initial cost has been the deciding factor, as generally these people have very little money to lay out. I am convinced, however, that the electric heating of such places is a commercial proposition. If I find that the running cost is hindering progress in this direction, especially as it is mostly a week-end load, I shall consider the question of offering special terms. One small chapel connected to the mains for heating has approximately 20,000 cu. ft. of air space with several large windows, and eight 2¼-kW fires were installed. For the year ended September 30th last the consumption was 2,003 units, which, at 1¼d. per unit, works out at £14 4s. 9d. To this must be added £3 for hire of radiators, making a total cost of £17 4s. 9d., and the authorities are very pleased with these results. There are to-day many cheap and inferior wall plugs on the market, and when these are installed to carry radiators up to 3 kW capacity, it is simply asking for trouble, putting the consumer to endless expense in repairs, in addition to inconvenience and annoyance. The abominable smell from the overheating of the insulating material of these inferior plugs is most unpleasant. I have endeavoured to get the Burton contractors to standardise on one make of plug; where these are installed it is extremely rarely that we receive any complaints, and on 200-volt circuits this is practically *nil*.

Undoubtedly the outstanding feature of the domestic load in the last two years has been the remarkable progress made with electric cooking. It is quite possible that it will eventually pay us to put cookers in consumers' houses on loan. Once the cookers are installed they are worth more than 5s. per quarter to the consumer, but if we are to tackle the class of people we really want a high rental will retard progress. The Gas Department in Burton fixes gas fires and cookers free of charge and free of rental, but notwithstanding this competition we are still forging ahead with electric cookers. We have 250 cookers fixed, and orders are coming in daily. Many testimonials have been received from consumers stating that the account for carrying out the whole of the cooking and the boiling of water with the kettle is cheaper than the previous method. One says:—"I find the cooker is inexpensive. I have in addition to the cooker an iron, and one radiator, and find, on referring to the accounts for the year ended March, 1924, the cost of the 'power' circuit (including the hire charge for the cooker and radiator) was £9 8s. 1d., which equals on an average 3s. 8d. per week. I do *all* my cooking with the cooker and boil *all* my water in the electric kettle, and I should have no hesitation in advising anyone to install one of these cookers, and, moreover, I scarcely like to think what I should do without mine."

Another consumer sends me the following comparative figures for the six months ended September 30th, for lighting and cooking:—

Six months ended 30/9/'24—Electricity, £6 19s. 11d.
Six months ended 30/9/'23—Gas, £7 6s. 10d.

This consumer's figures with electricity include 15s. for hire of apparatus, which, of course, did not appear in the corresponding gas figures, whilst there is an electric fire and iron installed and the illumination of the house has been practically doubled.

The second thing to impress me was the high diversity factor of the cooking load. In one of the outlying districts 52.5 kW of cooking apparatus alone is connected on the end of a main, the distance being approximately three-quarters of a mile, with 7/16 aerial. Whilst occasional complaints have been received of low pressure, unless there was a high diversity factor, cooking in this case would be absolutely impossible. There has been no noticeable increase in maximum load recorded at the power station due to the number of cookers fixed.

The third and most pleasing feature is the improvement in the mechanical construction, and simpler design compared with the older type cookers, their reliability in operation, and the absence of frequent breakdown.

Manufacturers would suffer little inconvenience or loss if they guaranteed oven and grill elements for three years or even longer, as not a single oven element has had to be replaced, and only one grill element has had to receive attention. For the six months ended September 30th, the total maintenance cost per cooker only was 2s. 10d. Part of this figure is due to dispensing with the reflectors under the boiling rings of the 1922 cookers, as it was found that these in time corroded very badly, and the manufacturers decided to discard them altogether. The maintenance cost per kettle for the six months was 1s. 6d. This figure is heavy, but is accounted for through sending all faulty kettles back to the makers for repairs, so that an automatic cut-out could be fitted; when all the kettles have been so equipped, maintenance costs will be very small. Twenty-three half spirals have had to be fitted to boiling rings in the six months. It is hoped that the total maintenance cost per cooker installation, including kettle, will eventually not exceed 5s. per annum. The open type boiling ring is the better—one fitted with a fireclay former with a spiral wound upon it, the fireclay former being so constructed that any liquids boiling over will run through on to the crown plate. These boiling rings appeal far more to the public, as they are able to see the red radiant heat, which is a great point, and in the event of any breakdown only the spiral needs to be replaced—in addition, it is *not* necessary to use special utensils with ground bottoms. Quicker results can also be obtained by red radiant heat than by conduction. Where complaint has been made of slowness, the loading of the ring has been increased to 2,000 watts, with the result that the consumer is quite satisfied.

It is important to keep the supply pressure up to normal, as, from observation, 10 per cent. drop in voltage means approximately 33 per cent. longer time taken for cooking operations, with consequent increase in consumption of energy. Pilot lamps are much appreciated by consumers, and prevent waste.

The four-pint quick-boiling kettle, which I believe most undertakings now include in the hire of the cooking installations, is a great boon to the consumer, and considerably reduces the bill compared with carrying out the same operations on the boiling rings. On the average the kettle consumes between 300 and 500 units per annum, and, once it is used, the consumer would absolutely not be without it. Taking people who use their cookers for all cooking operations and the kettle for boiling such water as is required in the kitchen, I find that at 1¼d. per unit the figures average out roughly as follows:—

Three in family	2s. 6d. per week.
Four in family	2s. 11d. per week.
Five in family	3s. 3d. per week.

Where cookers only are installed, the consumption varies between 850 and 1,800 units per annum, and a fair average is 1,400 units.

The public, being ignorant of electrical methods, wants to know what it is going to cost to cook by electricity, and the only way to answer this is to ascertain the number in family and give a straightforward answer in shillings and pence per week. Many persons, after receiving their first two quarters' accounts, have called in to inform the staff how close they have been to the figures quoted, at the same time expressing their satisfaction with the results obtained. All experience goes to show that the average housewife using an electric cooker can achieve results distinctly superior to those she can obtain by any other method.

Good service, coupled with reliable apparatus, is the best form of propaganda. All repairs should be carried out with the utmost speed without any charge, and all complaints carefully investigated. Periodical calls should be made on all cooking consumers to ascertain whether the cooker is giving entire satisfaction. The men fixing the cookers should be enthusiastic, and able to give advice and information. We have not had a single domestic cooker returned.

The units sold for cooking average out ten times the units sold for lighting only, and with other domestic apparatus increase the average revenue earned per service by 300 to 400 per cent.; in addition idle sections of the mains are carrying load in the daytime. The wiring installations for the cookers are put out to the local electrical contractors, and this encourages them to co-operate with the department, and so interest new consumers to make inquiries at the showrooms with a view to installing a cooker.

Domestic hot water requirements differ widely, and each case will have to be considered separately. Where baths are required on two or three definite occasions per week and probably in the evening, they can be catered for best by a 12-15-gallon unlagged tank fitted with immersion heaters having a loading as high as the installation will admit of, if possible, either 4 to 6 kW; three to four units are required to give a good bath of hot water. When, however, baths are required regularly, particularly if required in the morning, there are many points in favour of the small constant-loaded heater. The tank should be thoroughly well lagged and of such a size that if the constant loading is left on continually without water being drawn off, the water in the tank will barely reach boiling point. If a lagged tank with constant heater is required to give, say, two baths in quick succession, the capacity of the tank should be not less than 30 to 40 gallons, the constant loading being about 400 watts.

The ideal arrangement for a bath water heater is to have a thoroughly well lagged tank with a constant heater of suitable size, supplemented by a powerful booster heater, say, of an extra 4 to 6 kW. The constant heater could be taken *direct* from the supply main and supplied on a contract rate, and the booster heater could be taken through the meter in the house and charged at the *ordinary heating rate*. A pilot or indicating lamp should be fitted in conjunction with the booster heater. A moderate loading of, say, 2 or 3 kW, thermostatically controlled, would in most cases result in greater economy as regards energy consumption than the constant heater system, but the objection, so far, to this method is the difficulty in obtaining a suitable thermostat and switch at a reasonable price. Many cases have been successfully dealt with by fitting immersion heaters into the hot water storage cylinder or tank. The presence of the heaters does not interfere in any way with the normal heating of the hot water system by the range boiler. There is a good deal to be said for this as, of course, it gives load to the central station during the summer months only.

The consumer will ask: "What is electric water heating going to cost?" If the price is 1d. to 1¼d. per unit, a straightforward answer for intermittent requirements is that a bath can be obtained for 4d. This makes the client interested, and is not considered expensive.

Quite a demand exists for a good type wash boiler, but owing to the small revenue obtained, it does not pay supply authorities to let these out on simple hire terms. A hire-purchase scheme is necessary if wash boilers are to come into general use. The wash boiler should be strongly constructed, loaded to approximately 4 kW with three-heat control, and I prefer the immersion heater type to the one with the elements clamped to the outside of the boiler.

The cost of the vacuum cleaner is practically the *only* cost; it consumes so little energy as to be practically negligible in a quarter's account. It is the greatest of all labour savers. Washing machines cost about £40, and here again the only cost is the initial one, the consumption being so low. If the machines were half the present price there would be a reasonable demand.

It should be possible to obtain from the average small household comprising, say, three or four persons, using a coal fire in the living room, an annual revenue of £15, made up as follows:—

Lighting, 100 units at 6¼d.	£2	14	7
Cooking (including kettle), 1,100 units at 1¼d.	£5	14	7
Fires (occasional use), 350 units at 1¼d.	£1	16	6
Baths (say, 3 per week), 500 units at 1¼d. ...	£2	12	1
Wash boiler, 300 units at 1¼d.	£1	11	3
Washing machine, vacuum cleaner, and iron, 100 units at 1¼d.	£0	10	5
Total (2,450 units)	£14	19	0

This gives an estimated consumption representing 24 times the units sold for lighting only, and the occupier of the small house will be quite prepared to pay this figure, realising the saving in labour, the cleanliness, and the consequent saving in decorations.

Everything should be done to make it as easy as possible for the consumer to use the above appliances, and I am of the opinion that many of the "side" charges existing in some towns are a hindrance to progress. In Burton no charge is made for laying services up to 60 ft. on private property, the minimum charge clause has been abolished, there is no rental for heating meters, whilst no rental is charged on any other meters up to a capacity of 25 amps. This relieves the small consumer of many otherwise irritating charges and induces him to spend the money in hiring, or purchasing, apparatus which will be a constant revenue earner.

There is a danger in some districts of making the lighting rate too cheap: 6d. to 7d. per unit is a reasonable figure as a flat rate, and, if any concession is made at all, this should be to long-hour consumers only. If the flat rate for lighting is too low it will be most difficult to induce small householders to change over to any of the multipart tariffs now in operation.

Discussion.

Mr. W. B. WOODHOUSE, president, I.E.E., complimented the East-Midland Sub-Centre on its virility and usefulness. He commended their keenness and their determination to keep the interests of their profession well in the limelight. Their Institution was the largest engineering association in the country, and was making rapid progress. Its liveliness was due in no small measure to its democratic constitution; the benefits conferred on the members were undoubted.

Mr. J. F. DRIVER (hon. secretary of the Section) said that electrical engineers should have all-electric houses. The cost of energy in an electric cooker was met by the saving of the food cooked, and by the abolition of chimneys sufficient saving could be effected on building costs to pay for the complete installation of electricity. The introduction of electricity to farming, too, was a most important matter. The Leicestershire County Council in a few months' time would send out a demonstration van with a view to educating farmers in the advantages of electricity. In conclusion, he called attention to the poisonous nature of gas, and gave some interesting details of experiments in that respect. Far more people were poisoned by gas, as the newspapers showed, than were killed by electricity.

The MAYOR OF LEICESTER said the suggestion with respect to the abolition of chimneys was worthy of attention. Leicester was building 1,500 to 2,000 houses on a new estate, and if Mr. Driver could place a practical scheme before the Corporation on the lines he detailed it would receive very careful consideration. Electricity, undoubtedly, was far cleaner than gas, easier to manipulate, and less trouble in every respect.

Mr. T. R. SMITH, city electrical engineer, said he did not agree with Mr. Hall's contention that a higher rate for energy should replace a lower rental charge for the cooker. That method would increase the price for electricity for other purposes. The cooker consumed only a part of the household demand. Since the Leicester showroom was opened over 600 cookers had been installed, and orders were still coming in freely. The load called for on Sundays on this account was over 500 kW.

Mr. WEBB (Derby) referred to some experiments conducted in the heating of chapels in his district, it being found that the cost of electrical energy for that purpose was far lower than that of the hot-water method, besides being cleaner and quicker.

Several other speakers followed, dealing chiefly with the cooking problem and with the need for definitely ascertaining the exact cost of production per unit, with a view to a clear knowledge of the percentage of profit.

Mr. HALL, in a general reply to the discussion, claimed that the Electrical Development Association was doing even more efficiently for electricity what was done by the Gas Association for gas. He was not particular himself about the exact percentage of profit on each unit sold, so long as he was selling his load and holding his own against the gas department. His committee expected him to make so *much* profit per year, and to a large extent his policy was guided by that. As regarded the supply of electricity to farms, that must be looked upon as a commercial proposition, and each case treated on its merits. He was afraid in many instances they would be faced with a heavy expenditure for a small return.

Exports and Imports of Electrical Goods and Machinery in November, 1924.

THE electrical export figures for the month of November show a decline of £175,029 from the October total, large reductions being noted in electrical goods and apparatus (unenumerated), electrical machinery (motors and generators), submarine telegraph and telephone cable and instruments and apparatus. It is satisfactory to observe that the month's total is an improvement upon that of November, 1923. The electrical import total was slightly higher than in the previous month and £119,497 in excess of the November figures of last year. In the re-export section a decrease of over £7,000 is recorded, principally owing to falls in the values of re-exported unenumerated electrical goods and apparatus, insulated wires and cables, and telegraph and telephone instruments and apparatus.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Nov., 1924.	Inc. or dec. as compared with Oct., 1924.	Inc. or dec. as compared with Nov., 1923.	Electrical imports for Nov., 1924.	Inc. or dec. as compared with Oct., 1924.	Inc. or dec. as compared with Nov., 1923.	Electrical re-exports for Nov., 1924.	Inc. or dec. as compared with Oct., 1924.	Inc. or dec. as compared with Nov., 1923
Electrical goods and apparatus (unenumerated)	£167,317	− £15,465	+ £5,692	£98,806	− £910	+ £11,251	£5,372	−£4,969	+ £686
Insulated wires and cables	201,826	− 4,733	+ 2,392	49,971	+ 1,386	+ 25,171	2	− 1,305	− 48
Glow lamps	40,199	+ 4,871	+ 15,037	30,159	− 9,691	+ 4,664	434	+ 44	+ 69
Arc lamps and parts	979	− 155	− 4	1,631	+ 314	+ 438	42	− 38	− 419
Batteries and accumulators	71,863	+ 3,350	+ 9,833	57,196	+ 11,520	+ 38,219	279	+ 75	− 301
Meters and instruments	43,316	+ 9,955	+ 10,319	13,198	− 2,091	− 3,113	586	− 625	+ 24
Carbons	2,868	+ 2,259	− 1,998	8,851	+ 1,640	− 6,204	48	− 110	− 317
Electrical Machinery—									
Electrical machinery (unenumerated)	215,582	+ 25,966	+ 27,593	71,696	− 6,386	− 9,536	8,442	+ 1,230	− 6,918
Railway and tramway motors	105,423	+ 42,741	+ 69,011	—	—	—	—	—	—
Other motors and generators	169,346	− 111,318	− 23,507	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	5,252	− 2,043	− 227	30	− 207	+ 30	—	− 585	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	83,485	+ 9,743	+ 28,157	13,069	+ 483	+ 3,692	1,068	+ 795	+ 1,035
Submarine telegraph and telephone cable	21,982	− 110,587	+ 3,740	—	—	—	—	—	—
Telegraph and telephone instruments and apparatus	281,763	− 29,613	+ 125,187	112,737	+ 8,304	+ 54,885	2,228	− 1,810	+ 1,654
Totals	£1,411,201	− £175,029	+£272,625	£457,344	+ £3,362	+£119,497	£18,501	−£7,298	−£4,535
Increases for the eleven months ended October, 1924		Exports. +£2,850,078			Imports. +£776,594			Re-exports. +£35,916	

"Henley" Link Disconnecting Boxes.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., have introduced a new range of underground network boxes built upon novel, yet very simple lines. These boxes embody many new features and improvements making for simplicity of construction and erection, reduced cost of installation and efficiency in operation which will appeal to all who have to handle this type of apparatus.

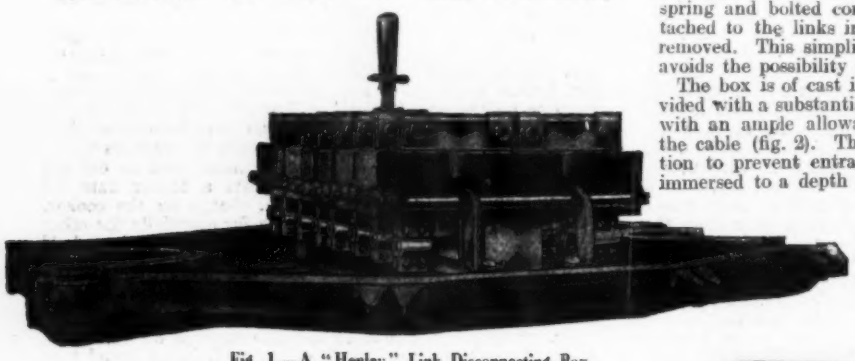


Fig. 1.—A "Henley" Link Disconnecting Box.

The interior fittings are of an entirely new and interesting design, being built up on the unit principle from standard material. All current carrying parts, *viz.*, the bus-bars, terminal pillars, and links, are mounted on porcelain insulators (fig. 1). These insulators are coloured in accordance with B.E.S.A. requirements to enable ready identification, thus preventing the crossing of poles or phases. The bus-bars, links, and terminal pillars are made from continuous lengths of high-conductivity copper strip without joints or contacts of any description except those provided for disconnecting the links. The links are of an improved type, combining spring and bolted contacts, the bolts being permanently attached to the links in such a way that the nuts cannot be removed. This simplifies operation in difficult situations, and avoids the possibility of nuts falling into the box.

The box is of cast iron split on the centre line, and is provided with a substantial tongue and grooved joint; it is roomy, with an ample allowance of space for splaying the cores of the cable (fig. 2). The diving bell lid is of generous proportion to prevent entrance of water, even though the box be immersed to a depth of several feet. Various types of interchangeable glands can be fitted for paper-insulated lead-covered and served or steel-tape armoured cables. Each gland has a pocket with large filling hole for filling with waterproof compound.

The actual method of jointing the cable is as follows:—The bottom half of the box is first placed in position after removing the cover and turret. The complete interior is then lifted bodily from the box by removing the fixing screws, and the links and the terminal pillars are removed from their respective porcelains. After cutting back the cable, allow-

Fig. 2.—Box, with Diving-Bell Lid, showing space allowance.

ing about half an inch of lead sheath to project inside the inner flanges of the wood bush, the armouring is cut back to suit the particular type of gland used. Then the cores of the cable are splayed out and the conductors bared to the required length. (A boss is cast on the box to mark the position of the terminal pillars to ensure cutting the core to the right length). The conductors are then connected to their respective terminal pillars, which are provided with four clamping screws in addition to a sweating hole.

The frame carrying the insulators is then passed over the fittings, the split pin, screws and links are replaced, the compound is poured in, and the turret and lid are put on.

The boxes are arranged for 2-, 3-, and 4-core concentric and triple-concentric cables, in "straight-through," and three- or four-way patterns.

Steady High-Voltage Direct Current from a Thermionic Rectifier.

By F. W. MAXSTADT.*

MANY types of circuits have been suggested and used for stepping up a sine-wave single or polyphase low-voltage alternating current and then rectifying by means of either a synchronous commutator or one of the forms of electric valve. The resultant unidirectional potential and current have an alternating component which must in many cases be eliminated. The apparatus which suppresses this alternating component consists of condensers suitably connected with reactors and tuned to draw a large current at the principal frequency of the undesirable wave, *i.e.*, the sixth harmonic of the fundamental impressed on the low-voltage side of the rectifier. For voltages up to 15,000, such a filter is a fairly easy problem,

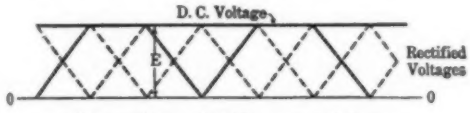


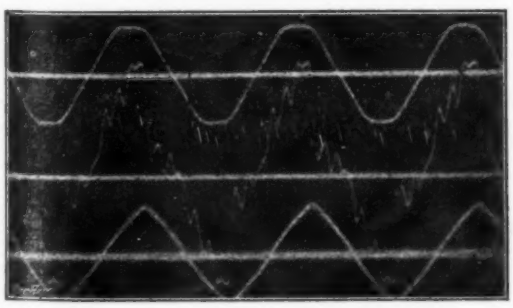
Fig. 1.—Theoretical Diagram of Voltages.

but for 100,000 volts or more the condensers become bulky and expensive.

In order to avoid the necessity for a filter, the wave form of the alternating potential impressed on the transformer low-pressure side must be of special shape.

A three-phase star-connected winding has voltages across its terminals which are the instantaneous *differences* of the component leg voltages, and it will be seen by an inspection of the ideal diagram, fig. 1, that by generating a triangular wave in each leg of the star, a wave, horizontally flat for 60 electrical degrees of every half-cycle, results, which contains, theoretically, no third harmonic, 4 per cent. fifth, 2.04 per cent. seventh, no ninth, 0.828 per cent. eleventh, &c. Even harmonics and multiples of three are absent.

Mechanically, the generator has a 50 per cent. pole arc and a coil span of 50 per cent.; thus the generated voltage in one leg of the star is zero only when the armature coils



Upper curve—Terminal voltage (load consists of exciting current on transformer bank only).
Middle curve—Exciting current, Transformer No. 1.
Lower curve—Voltage of one leg of generator.

Fig. 2.—Voltage Wave Forms on the special Flat-top Wave Generator.

are all in the interpolar space, and maximum only when they are all under the poles. Intermediate voltages are proportional to the number of conductors under the pole, and hence proportional to angular displacement from a reference point. This forms a triangular wave. The other necessary conditions are: no flux fringing at the pole tips and uniform distribution under the poles. How closely these conditions can be met experimentally is shown by the oscillogram, fig. 2. The top curve shows generator terminal voltage, the middle curve transformer exciting current on the flat-top wave, and the lower curve, voltage on one leg of the generator.

* From the *Journal* of the American Institute of Electrical Engineers, November, 1924.—Abstract.

The experimental generator was a rebuilt Crocker-Wheeler bipolar 10-kW d.c. machine having a smooth core, 8-in. diameter armature, and ⅜-in. air gap. The armature was specially wound as described above. The field poles were cut away to suit, and a pole face "compensating" winding inserted to control the flux distribution under load conditions.

Fig. 3 is a diagram of connections using the Δ arrangement. The rectifier consists of six standard 100,000-volt,

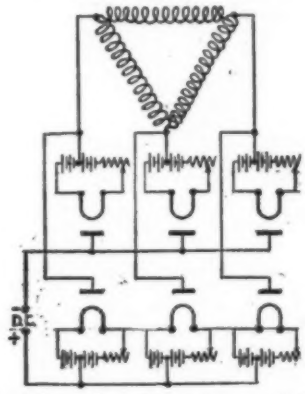
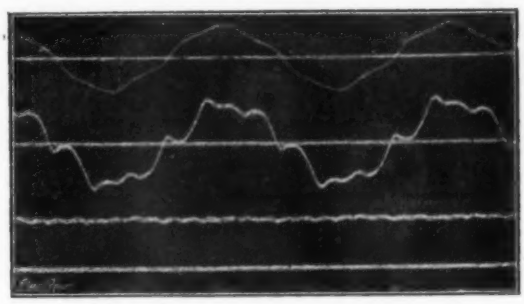


Fig. 3.—Diagram of Connections of Transformer and Rectifier, showing the six Kenotrons.

200-milliampere Kenotron tubes with storage battery excitation for the filaments. A 51-cycle flat-top voltage was impressed on the transformers.

Experimental Results.

Rectification of 100,000 volts and 50 milliamperes, 5 kW, was accomplished, limited by the 7½-h.p. driving motor on the generator, and the transformer bank, although the Kenotrons were capable of 20 kW output. Fig. 4, showing impressed voltage and current on No. 1 transformer and d.c. current in a water resistance, for a star-connected bank, shows a maximum variation of 2.8 per cent. on each side of the mean. The efficiency was 80 per cent. Prominent third



Upper curve—Transformer impressed voltage.
Middle curve—Current in transformer, low side.
Lower curve—D.c. in a water-tube resistance.

Fig. 4.—Characteristics of the Rectifier.

and fifth harmonics appear in the current wave drawn by the transformer. The even harmonics are absent.

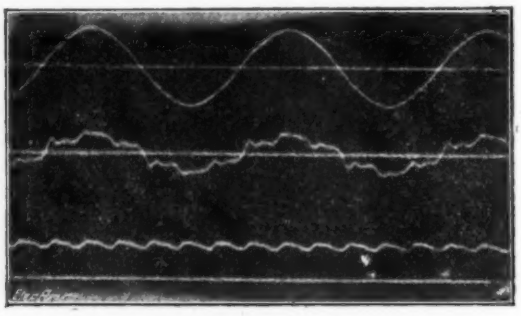
Further improvement is to be obtained by using lower-impedance transformers and a smaller air gap in the generator.

For comparison, fig. 5 is presented to show the action of the rectifier with a sine-wave voltage impressed. The maximum variation of the direct current from its mean was 10.5 per cent. It will be noted that the rectified currents produced by the flat-top wave have sharp dips occupying only

about 5 per cent. of the time duration of the steady portion, so that even though the amplitude of the dip is four or five per cent. of the total current, its net result is quite small. Sine wave impressed voltage, however, produces ripples occupying the whole time duration of the direct current.

There are several advantages in producing a steady high-voltage direct current without the use of a filter:—

1. The expense and weakness of a high-voltage condenser are avoided. For radio work and X-ray tube operation this is important.
2. Space requirements are reduced.
3. Power losses in the filter are avoided.
4. Steadiness of direct current changes very little with load, whereas the filter may change its tuning under load variations.
5. The practical upper voltage limit of the rectifier is raised.
6. Undesirable even harmonics which sometimes result from



Upper curve—Transformer impressed voltage.
Middle curve—Transformer current on low side.
Lower curve—D.c. in water-tube resistance.

Fig. 5.—Characteristics of the Rectifier on Sine Wave Voltage.

polyphase rectifier loads on a power system are completely avoided.

7. The recent exhibition in England of a high-voltage d.c. machine, designed by Messrs. Highfield and Calverley, has awakened new interest in the possibilities of d.c. power transmission. The feasibility of getting a better and more easily controlled wave form for thermionic tube rectification may be another step in the solution of the d.c. transmission problem.

Parliamentary.

[By Our Special Parliamentary Reporter.]

The King's Speech.—Parliament was opened by the King in person on December 9th.

The Speech from the Throne promised that attention would be given to schemes for the relief of unemployment; to the speeding-up of house building; to the amendment and consolidation of the Factory and Worshop Acts; to the encouragement of trade between the various parts of the Empire, &c. It also expressed the Government's intention not to ratify the Russian treaties, and to confirm the Anglo-German agreement.

During the debate on the motion for the presentation of an address in reply to the King's Speech, Mr. CLARRY, the Unionist member for Newport, said he regretted that there was no reference in the Speech to electrical development, nor to anything connected with our coal resources or their conservation. The production of 95 per cent. of the electricity in this country necessitated the consumption of coal. He suggested that the right way to deal with the matter of coal conservation and electrical development was through active co-ordination between the sister industries of gas and electricity, and he maintained that sufficient could be said to make a case for an inquiry on the subject.

Special Electricity Orders.—On December 10th, on the motion of Lt.-Col. ASHLEY, Minister of Transport, Special Orders made by the Electricity Commissioners and confirmed by the Minister of Transport, were approved in respect of Adwick-le-Street, Kempston and parts of the rural districts of Bedford and Biggleswade, Perry Barr, Brundall, Blofield, and Witton, and part of the parish of Great Plumstead, Callington and part of the parish of Stoke Climsland (Cornwall), parts of the parish of Cambuslang, and the parishes of Cheslyn Hay, Hatherton, and Huntington, and parts of the parishes of Great Wyrley, Penkridge, and Kinvaston (Stafford).

Electricity Charges.—On December 11th, Mr. ALEXANDER asked the Minister of Transport whether he was aware of the dissatisfaction of residents in the Twickenham area with regard to the supply and cost of electric current, which was now charged for at the rate of 11d. per kWh, although the supplying company was paying 10 per cent. on its share capital.

COLONEL ASHLEY said that a number of complaints on this subject had been brought to his notice. The powers which he possessed were to regulate the *maximum* prices which might be charged, and under the Electricity (Supply) Acts these charges might be reviewed after a period of three years on the representations of either (1) the undertakers, or (2) a number of consumers, or (3) the local authorities. The present maximum prices in this area were regulated by an Order made by his predecessor in December, 1920, but the actual charges in force were below that maximum. It was open to the consumers or the local authority to apply for a revision of that maximum. No such application had, however, been made.

Wireless Telegraphy Act.—On December 12th, during the consideration of the Expiring Laws Continuance Bill, Lt.-Commander KENWORTHY moved to omit from the scope of the Bill the Wireless Telegraphy Act of 1904. He said he did so in order to ascertain if the Government had a policy with regard to Imperial radio-telegraphy. He also urged that the Postmaster-General should give publicity to the danger in which homing pigeons stood from wireless aerials.

SIR W. MITCHELL-THOMSON, Postmaster-General, in reply, said that the question of Imperial radio-telegraphy was engaging the close attention of the Government. With regard to the question of homing pigeons he would take note of what Lt.-Commander Kenworthy had said and give consideration to it. The present Act was only a temporary measure and early in the session next year the Government intended to introduce a Bill to make the Act permanent and to make certain amendments and improvements in it which experience had shown to be desirable.

The amendment was, by leave, withdrawn.

Correspondence.

Correspondents should forward their communications* at the earliest possible moment.** ***No letter can be published unless we have the writer's name and address in our possession.

British Municipalities and Foreign Electrical Plant.

I have read with a good deal of amusement the correspondence on the above subject, and also that *re* "Trade Discounts and Direct Trading." The gentlemen who have been good enough to entertain us show the British manufacturer from two viewpoints. On the one hand he wants all the protection he can get against foreign competition, even if it involves a heavy tax on the ratepayers generally and prevents the more extended use of electricity by his working-man friend and the resultant benefit to the community generally which the wider use of electricity would bring. "Sell British and Starve" shows up the other manufacturer's utter disregard for the trading class, British or otherwise. As long as "Manufacturer" has things his way the rest of the community can go to a place where discounts cease to trouble and the rotors are at rest. The conclusion one comes to after reading "Manufacturer's" letter is that Newport has done the right thing, and anyone who has finished taking off his hat to France and wants another and a sane reason for taking it off again, can remove it to Newport.

Some years ago a gentleman who was connected with one of our big semi-public bodies told me that his people asked for tenders for a lot of constructional steel, and when the tenders arrived, although the tenderers did not point out that their price had been settled after consultation together, his people came to the conclusion that it was not necessary to have such an intimation. They at that time thought that capital expenditure had to earn something, but in order that it might do so they would have had to raise their rates to the public, which they considered high enough already, and they therefore did not proceed with the matter. The result was that a number of workmen who would have been employed on the erection of the steel were not employed. Had they ordered from abroad the workmen here would not have had the job of making the steel, but far more men would have been employed on the erection of it, so that a loss to the workers in one direction would have been more than compensated for in another. "Manufacturer's" considerations 1, 2, 3 and 4, do not make the slightest impression on me as they are not complete. Dealing with things as they are, I think the distance which separates "Manufacturer" from Communism is a very small one, as if he really believes that it is good for one industry to have the monopoly of municipal orders—*i.e.*, the orders of the ratepayers—he surely will not grudge the benefit to other industries, in which case we should all be working for the municipalities; for, if by doing work municipally, work is made for British manufacturers, only let the municipalities carry on all businesses and then we shall have arrived at the goal of the Communist.

Years ago, long before the war, I remember you used to be always impressing on the manufacturers the necessity of looking after their laurels and you gave them all the information you could gather as to what their competitors were doing. In fact, you combined the critic with the helper. The war has given our manufacturers a very easy time, but they have now to face competition, and if a Swiss firm can give them a 50 per cent. beating they will certainly want all the help you can give them. The Newport matter is not a very good advertisement for them. "Salesman" says "Manufacturer" could pick up many a hint on the Continent, but "Manufacturer"

says he has been there. The question then arises: Through what spectacles were they looking? Emerson truly said that the chemist could tell his greatest secrets to the carpenter. Does "Manufacturer" take advantage of all the help which has been given to him? I begin to wonder whether he really wishes to be considered a manufacturer or a Communist. If as the former, he has not written to the point except for himself, and if that is what he intended to do, he should have called himself an Individualist, but as an Individualist he could not have blamed Newport for acting as such.

What he expected municipal engineers to say in reply I do not know, but if he thought that anyone who had bought an article for 50 per cent. less from one source than another, had had before doing so to go through a lot of mental considerations which would fill your columns, he is paying a very poor tribute to our English brains, even if they are not the brains of a manufacturer.

The Swiss are not noted for giving anything away, and possibly when "Manufacturer" was on the Continent he heard the expression: "Pas d'argent, pas de Suisse," which means, I understand, "No money, no Swiss." I have no doubt that the Swiss, in making their tender did not omit any items, and the best thing "Manufacturer" can do is not to give the Swiss firm any more advertisement but to employ Swiss brains in his works, or try by some encouragement to get better results from his English brains. He should get to work at once and be ready to try for the next contract which is going. As to what "Salesman" has learned, he distinctly pointed out that it would be useful to a Royal Commission, and therefore there is no point in asking him to give it away now. He endeavours to draw "Salesman," suggesting that he refers to British manufacturers selling their goods dearer on the home market than on the foreign. Does "Manufacturer" know they do this? If so, one might suggest to him that he publish what he knows, as this would certainly be a bad practice and it is surely, to use his own words, in the interests of the industry that it should be exposed without delay. I have been told of one branch of the industry in which this practice prevails, but as I was told in confidence I cannot publish the information; but if "Manufacturer" knows of his own experience that it is done, he might without scruple publish all he knows, explaining at the same time that a buyer in paying more for the real British article than the foreigner is paying for it, is supporting this particular branch of the electrical industry—*i.e.*, he is assisting the foreigner to buy cheaper than he can buy. You can almost hear the British buyer asking if there are no other goods for which he can pay more and help the foreign buyer to get an extension of this advantage.

As to the question to "Salesman" about Santa Claus, "Manufacturer" should address this to one of the spiritualistic members of the industry. There was nothing to suggest Santa Claus or Guy Fawkes in "Salesman's" letter.

Well, Mr. Editor, I will not take up much more of your valuable space. I have been a subscriber to your paper for many years, so I know its characteristics—impartiality and fearlessness. You have given "Manufacturer" his fling, but I am sure your readers generally must be puzzled as to what his grievance is. At times he seems to pose as the champion of the municipal engineers who are under the authority of the municipal governing bodies. What does he advocate: does he suggest that they should do as they like? He should first let his own employés understand that they can do as they like, and later relate his experiences—*i.e.*, if still in the service of the employés. He is disappointed that municipal engineers have not come forward to reply to him. He might be disappointed still further if they did, as possibly they would give a better advertisement to Swiss plant than it has had; so in his place I should not regret their silence. As a matter of fact I do not think they trouble whether "Manufacturer" blows hot or cold about them. They have not possibly an easy time, and in advising their councils they have a right to claim to give advice according to their conscience—whether it is in favour of British or Swiss plant. As I understand "Manufacturer," British municipalities should only buy British plant and logically Indian municipalities should only buy Indian, and Egyptian only Egyptian manufactures. Better to go on as we are doing than to provoke any more boycotts.

Free Trader.

London, *December 8th*, 1924.

In your issue of the 12th instant, you publish a further criticism by "Salesman," and through your courtesy I have the advantage of also dealing with the letter signed "Free Trader," which will appear in the same issue as this.

I would explain that I am leaving town almost immediately and shall therefore not be able to take any further part in this correspondence. If it should be continued, I hope it will not be thought that my batteries have been silenced by any arguments which may be adduced by my opponents.

Knowing the demands which are made on your space, I will refrain from following in detail the somewhat discursive comments made by the correspondents to whom I have referred. One of them accuses me of sighing for a tariff, and the other tells me that municipal engineers have taken no cognisance of my article. For their information I would remark that both statements are inaccurate. To avoid wasting space on details I will re-state in different words the case which I have already presented.

It is clear from the daily Press that the Government views with alarm, and is taking steps to prevent, the import into Great Britain of low-priced alien workers. It should be clear to everyone that the reason for this is because we have a large number of unemployed to support, and it is not thought desirable to add to the number by allowing foreign labour (however cheap and skilful) to invade our labour market. As to whether this is a wise policy or not I leave it to "Salesman" and "Free Trader" to argue.

If it is a wise policy, it surely follows that there is nothing sinister in my suggestion that municipalities should not only avoid replacing British labour with foreigners, but that there is precious little difference between doing this and employing foreign labour on the Continent to supply their needs in electrical plant. It is granted that they can get their plant cheaper from abroad, just in the same way as they could get their labour cheaper. It is also granted that certain British manufacturers have combined and settled minimum prices exactly in the same way as, and because, British labour has fixed rates of pay which municipalities insist on recognising.

The reason I have argued the case for municipalities buying British goods and have not said anything about companies and private traders is because of the unfair manner in which certain municipalities insist, in the case of British firms, that they should pay the British trade-union rates of wages and then proceed to place their orders abroad without any sort of effective restriction in the same sense.

Another reason why municipalities should be prepared to pay higher prices for goods made by British labour is because in the aggregate the ratepayers have to provide the means for paying the dole to the unemployed. It is true that particular municipalities can save money here and there by sending their orders abroad, but in doing so, they merely throw a greater burden on those municipalities that consider it wise to employ British labour and British plant.

Manufacturer.

December 12th, 1924.

[This correspondence is now closed.—EDS. ELEC. REV.]

Trade Discounts and Direct Trading.

The letter in your last issue under the above heading subscribed "Sell British and Starve" raises a point which is of considerable interest to us, though most certainly we do not endorse your correspondent's conclusions.

It is a most regrettable circumstance that members of the B.E.A.M.A. have adopted the policy of quoting the same terms to users of electrical plant as to contractors. The natural result is that firms like mine which specialise in power work are forced to buy from manufacturers who give a preferential discount.

But there is no need on this score to buy foreign plant, for there are many British manufacturers who make first-class motors and switchgear and who have definite prices for users and sellers.

There can be no doubt that this policy of the B.E.A.M.A. must result in the aggregate in the loss of a large volume of business, and I venture to predict that as a consequence its members will be obliged ultimately to come into line with "non-ring" manufacturers and adopt a selling policy in conjunction with genuine contractors, which is usual in most other trades.

The Midland Electric Power Installation Co.
H. JOSEPH, *Proprietor.*

Wolverhampton.
December 8th, 1924.

Illumination of Large External Areas.

I note in your columns letters from Messrs. John I. Hall and Harry E. Johnson in reference to my article under the above heading.

In the first place I am very pleased to hear from both these gentlemen that the problem to which I referred has been solved. It would seem, however, that users, to whom such a matter should be of very great importance, are not readily availing themselves of such systems as are referred to by your correspondents.

To quote one application, *i.e.*, shipbuilding yards, I do not know of a single yard in the Clyde or the Tyne area that does not continue to utilise the orthodox system for external illumination. Referring to Mr. Hall's letter, I am not familiar with the system to which he makes reference, and as he does not quote the all-important factor of current consumption, I am unable to make any observations. With reference to Mr. Johnson's remarks, I do not think I even suggested that the problem of external illumination was an insoluble one, neither did I claim any originality for the idea. It came to my own mind some time in 1917. It may, of course, have been adopted earlier than this. Mr. Johnson admits that the arc crater possesses high intrinsic brilliancy, but its many difficulties make it a failure for general industrial purposes. His reference to the arc crater in this instance I take it refers to the pure carbon arc burning in projectors, as I have suggested. What disadvantages are there? I would remind Mr. Johnson that searchlight projectors have been used for a considerable number of years (and continue to be used) in both branches of the Navy. They were also used in considerable numbers by the Army during the late war. Under these conditions they were and are subjected to very

severe forms of ill-usage. Yet I do not think that there is a single instance on record of failure at a critical moment during the period 1914-1918. The only objection that can be brought against searchlight projectors for industrial purposes is the comparatively short period of burning with standard lamps. This failing could be obviously remedied by making provision for an increased length of carbon. Both your correspondents comment upon my disregard for the gas-filled lamp. I have had a number of years' experience in the application of these lamps, and whilst it will be agreed that they have extensive uses, it must also be admitted that they have their limitations.

The bone of my contention is that by the introduction of the pure carbon arc having admittedly a higher intrinsic brilliancy than that obtainable from the filament of a gas-filled lamp, and further by approaching the "point source" to a far greater degree than is obtainable with any shape of filament, such an arc is more suitable for accurate focusing than could be otherwise obtained. It will be noted that I have made no reference to the vapour arc, wherein an intrinsic brilliancy in the neighbourhood of 500 candle-power per sq. mm. can be obtained. My reason for omitting this type of projector from my proposal is that the mechanism which is necessary for its operation is perhaps rather too delicate for industrial purposes. This is a point, however, which would need confirmation by practice.

In conclusion, I may mention with regard to the proposals put forward in my article, although they have not been actually applied as far as I know in the form laid down, yet in the course of experience with searchlight projectors it has been found that with no more efficient reflector than a *heavy ground mist*, it has been possible to carry out very close work at a distance of about 200 yards from the projector, with the beam projected approximately 60 deg. above the horizontal. In this particular instance, the projector was of the 90-cm. type, taking a current of about 90 amperes.

Leslie G. Toplis.

Bothwell, *December 9th*, 1924.

Penny Postage.

Public departments are always exposed to danger from the unmerciful axe of retrenchment when their estimates come before a harassed Chancellor of the Exchequer, especially if they happen to be operating at a loss.

When a department is in charge of a highly technical branch of the public service, such as "Telegraphs and Telephones," the "cut" usually means a stoppage of all modernisation. Hence the danger of a public clamour for penny postage at the present time. In all honesty we should recognise that twelve letters cannot be carried for a shilling without serious loss, while present prices of labour and material prevail. Ten letters to the shilling would be a reasonable demand, and could easily be met by selling 10 stamps for a shilling, or better still by increasing the value of our penny to a tenth of a shilling. Incidentally, such a change would give nearly all the advantages of a decimal coinage. If the quoting of prices for ordinary goods were made in shillings only, our Continental customer would imagine that our coinage was quite decimal and would rejoice accordingly.

Edward C. Barton.

London, *December 10th*, 1924.

The Radio Industry.

A statement recently appeared in the wireless trade papers by the N.A.R.M.A.T., in which it was observed that as "no trading body covering the whole radio industry as a separate entity and pledged to support British goods" existed *they (the N.A.R.M.) "approached a representative number of dealers."* In the face of this well-known fact the remark that "the suggestion that the traders should enter the N.A.R.M. itself came from the trade alone" is merely amusing.

Can it be reconciled with the regulation which arrogates to manufacturers alone (1) the fixing of discounts, and (2) the right to place retailers on the stop list without consulting the proposed Retail Section? In what kind of estimation can they hold the dealer who, they appear to imagine, will voluntarily tie himself to an organisation in which on the two matters which most vitally concern him he is to have no say at all? What kind of freedom does this portend? I sincerely trust that retailers will answer these questions by joining the Association whose first and foremost object is to protect their interests.

Fredk. S. Horsey,
Chairman, Wireless Retailers' Association.

London, *December 12th*, 1924.

Railway Electric Crane.—A special electric travelling crane for use on railways has lately been completed by the Becker Maschinenfabrik Gesellschaft, of Reinickendorff, near Berlin, Germany. The crane is mounted on a six-wheel railway wagon and is intended for loads up to two tons. It is of the jib type and is able to operate within a diameter of 35 ft. A feature of the machine is that to enable it to be taken to any desired point on a railway system, pass through tunnels, under bridges, &c., the jib is pivoted at its base so that it can be lowered and supported on a second wagon.

Published Specifications.

Compiled expressly for this journal by Patent Agents.
The name of the applicant's patent agent, if any, will be found on the printed specification.
The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1923.

13,253. "Electromagnetic separation or concentration of minerals." W. M. Mordey. May 17th, 1923. (224,924.)

18,466. "Telephone systems." Compagnie Generale de Telegraphie Sans Fils. May 5th, 1923. (215,299.)

18,823. "Telephone transmitters and receivers." A. F. Sykes and Marconi's Wireless Telegraph Co., Ltd. July 21st, 1923. (224,936.)

20,643. "Switching devices." Western Electric Co., Ltd. (Western Electric Co. Inc.). August 14th, 1923. (224,940.)

20,896. "Electrically-controlled cloth guiders." A. Wood and G. Wood. August 17th, 1923. (224,943.)

20,975. "Safety devices of the automatic cut-out type for alternating-current circuits." F. B. Cox. August 18th, 1923. (224,946.)

21,094. "Electrical hot-plates." A. F. Berry. August 20th, 1923. (224,951.)

21,183. "Electron discharge devices and circuit arrangements therefor." British Thomson-Houston Co., Ltd. October 3rd, 1922. (205,058.)

21,330. "Emergency brake for electric trams." W. Binny. August 23rd, 1923. (224,963.)

21,551. "Telephone receivers." W. J. Palmer and T. Thorne-Baker. August 25th, 1923. (224,971.)

21,558. "Magnetic alloys and their application in the manufacture of telegraphic and telephonic cables." W. S. Smith and H. J. Garnett. August 25th, 1923. (Cognate applications 22,487/23, 30,227/23, 31,116/23, and 10,977/24.) (224,972.)

21,745. "Protective apparatus for electric circuits." T. W. Ross and Metropolitan-Vickers Electrical Co., Ltd. August 28th, 1923. (224,978.)

21,814. "Electric circuit-breakers." English Electric Co., Ltd., and F. Morris. August 29th, 1923. (224,980.)

21,990. "Electric terminals." J. H. Brown and E. Scott. August 31st, 1923. (224,983.)

22,385. "Electric switches." E. Watkinson. September 5th, 1923. (224,987.)

22,799. "Electric coupling devices for railway vehicles." A. V. Tomlinson (Westinghouse Air Brake Co.). September 11th, 1923. (224,990.)

22,822. "Electromechanically-operated switch devices." English Electric Co., Ltd., and T. Zweigbergk. September 11th, 1923. (224,991.)

22,919. "Electric switch mechanism." H. A. H. Nijland. September 12th, 1923. (224,993.)

23,024. "Container for portable secondary batteries." K. E. Edgeworth. September 14th, 1923. (224,994.)

23,329. "Device for terminals in connection with wireless apparatus." G. Evans. September 18th, 1923. (224,996.)

25,087. "Mechanical power accumulator for mechanically-propelled vehicles." J. E. Crone. October 9th, 1923. (225,013.)

26,710. "Thermionic apparatus." F. Holweс. October 27th, 1922. (206,155.)

27,171. "Crystal rectifiers for wireless reception." K. H. Hawkins. October 30th, 1923. (225,032.)

27,351. "Optical receivers for type-printing electric telegraphs." Etablissements E., Berlin. November 4th, 1922. (206,504.)

27,608. "Incandescent electric lamps." E. R. Grote. November 2nd, 1923. (225,038.)

28,130. "Construction of panel boards for wireless signalling and other apparatus." Radio Communication Co., Ltd., and R. E. Beswick. November 8th, 1923. (225,043.)

28,948. "Electric overload switches or cut-outs." A. P. Stockings. November 16th, 1923. (Cognate application 2,679/24.) (225,050.)

29,123. "Anodes for use in electroplating." G. Jones. November 19th, 1923. (225,052.)

29,466. "Wireless receiving apparatus." M. R. Cahill. November 22nd, 1923. (225,056.)

29,477. "Method of electroplating aluminium and its alloys." W. H. Dyson and H. Sutton. November 22nd, 1923. (225,058.)

30,210. "Insulating handles, knobs, or the like." W. J. Sharplin. November 30th, 1923. (225,063.)

30,572. "Automatic and semi-automatic telephone systems." Coventry Automatic Telephones, Ltd., and J. E. Collyer. December 5th, 1923. (225,068.)

31,238. "Lamp shades for use with incandescent electric lamps." J. Mersing. December 12th, 1923. (225,075.)

32,332. "Globe and reflector fittings for electric lamps." J. Stone and Co., Ltd., and J. F. B. Vidal. December 27th, 1923. (225,080.)

32,516. "Electric fires." H. H. Berry. December 29th, 1923. (Cognate application 1,784/24.) (225,081.)

1924.

1,663. "Gasfilled electric lamps." Naamlooze Vennootschap Philips Gloeilampenfabrieken. February 14th, 1923. (211,453.)

1,928. "Crystal detectors or rectifiers for wireless apparatus." G. C. Simmonds and N. B. Simmonds. January 24th, 1924. (225,092.)

1,948. "Wireless apparatus." L. Levy. August 24th, 1922. (Divided application on 202,988.) (210,440.)

5,812. "Electrodes for electric arc welding and like operations." D. T. Smout. March 6th, 1924. (225,102.)

6,643. "Systems of electric ship propulsion" British Thomson-Houston Co., Ltd. March 14th, 1923. (212,939.)

7,093. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd. June 25th, 1923. (218,243.)

7,150. "Method of varying the speed of alternating-current electric motors." British Thomson-Houston Co., Ltd. March 20th, 1923. (213,272.)

8,456. "Means for removing heat from electric coils embedded in an insulating substance." E. Pfiffner. April 3rd, 1923. (213,918.)

8,690. "Securing devices for electric cables." Callender's Cable & Construction Co., Ltd., and S. J. Bryce. April 7th, 1924. (225,114.)

10,801. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. September 7th, 1923. (221,474.)

12,616. "Electrical resistances." T. C. Ball. May 22nd, 1924. (225,132.)

13,294. "Variable or adjustable resistances or rheostats." H. Patterson. May 30th, 1924. (225,137.)

13,529. "Electric contact plugs." Naamlooze Vennootschap Philips Gloeilampenfabrieken June 9th, 1923. (217,220.)

14,747. "Electric cables." S. Silbermann. June 30th, 1923. (218,279.)

15,536. "Loop or frame aerials for wireless signalling." Rodo Patents, Ltd., and F. A. L. Sloot. June 27th, 1924. (225,148.)

16,195. "Circuit arrangements employing thermionic valves." British Thomson-Houston Co., Ltd. July 5th, 1923. (218,681.)

17,464. "Transporting or protecting devices for sparking plugs." A. G. Beru. April 4th, 1924. (225,154.)